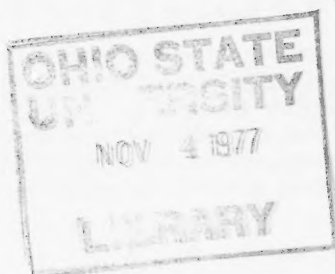


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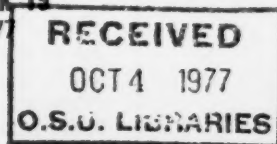
SELECTED ≡ WATER RESOURCES ABSTRACTS

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VOLUME 10, NUMBER 19
OCTOBER 1, 1977

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,
U.S. Department of the Interior



VOLUME 10, NUMBER 19
OCTOBER 1, 1977

W77-09101 -- W77-09600

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Depart-

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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FOREWORD

Selectd Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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- 02 **WATER CYCLE**
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.
- 03 **WATER SUPPLY AUGMENTATION AND CONSERVATION**
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.
- 04 **WATER QUANTITY MANAGEMENT AND CONTROL**
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- 10 **SCIENTIFIC AND TECHNICAL INFORMATION**
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

AN OPERATIONAL APPROACH TO PRESERVING SKEW IN HYDROLOGIC MODELS OF LONG-TERM PERSISTENCE.
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, and S. J. Burges.
Water Resources Research, Vol 13, No 2, p 281-290, April 1977. 8 fig, 5 tab, 20 ref. NSF DEB74-20744/A01.

Descriptors: *Hydrologic systems, *Monte Carlo method, *Model studies, Hydrology, Probability, Markov processes, Simulation analysis, Parametric hydrology, Hydraulic models.
Identifiers: *Skewed distributions, Gaussian noise, Long-term persistence, Log normal distribution, Nonlinearity, Distortion, Coefficient of variation, Gamma distribution.

Formulation of two models of long-term persistence, fast fractional Gaussian noise (ffGn), and the first-order autoregressive-first-order moving average process for a three-parameter log normal and three-parameter gamma distribution were given. For the three-parameter log normal distribution, the marginal probability distribution was generated exactly for both models, but the desired autocorrelation functions were distorted. Because of the nonlinearity of the three-parameter log normal transformation, sequences with slightly higher long-term persistence had to be generated in the logarithmic domain to achieve the desired model properties in the skewed domain. For the gamma distribution, the autocorrelation function was preserved exactly, but the desired marginal probability distribution was distorted. Monte Carlo tests showed that the distortion was evidenced primarily in the loss of the theoretical lower bound of the gamma distribution. The distortion was most extreme for time series having high long-term persistence and large coefficients of variation. For operational applications, there appeared to be no clear advantage to use of either of the skewed distributions. (Robert-ISWS)
W77-09127

THE OPERATIONAL WATER QUANTITY MODEL.
Central and Southern Florida Flood Control District, West Palm Beach. Resource Planning Dept.
For primary bibliographic entry see Field 4A.
W77-09204

HYDROLOGY OF TWO SMALL WETLAND BASINS IN EASTERN MASSACHUSETTS.
Lowell Univ., Mass. Dept. of Earth Sciences.
A. L. O'Brien.
Water Resources Bulletin, Vol. 13, No. 2, p 325-340, April 1977. 10 fig, 3 tab, 11 ref.

Descriptors: *Wetlands, *Hydrologic budget, *Massachusetts, Groundwater movement, Evapotranspiration, Swamps, Peat, Muck soils, Rainfall, Precipitation (Atmospheric), Runoff, Base flow, Streamflow, Instrumentation, Observation wells, Geology, Hydrogeology, Permeability, Hydrographs, Watersheds (Basins), On-site investigations, Groundwater, Hydrology.

A hydrologic budget was prepared for two geologically different wetland basins in eastern Massachusetts for the 1971 water year. Water table conditions prevailed at one wetland underlain by peat, while an artesian system functioned at the other wetland which was underlain by muck. Hydrologic responses generally were similar at both wetlands, although each functioned differently in detail. Both wetlands exhibited high spring discharges and depressions of low flow.

Groundwater accounted for an estimated 93% of the total annual discharge from both wetlands; in late summer, the peat deposit recharged the regional groundwater body. Evapotranspiration in the spring was retarded in probable consequence of the extreme wetness of the wetland soils. (Sims-ISWS)
W77-09336

SENSITIVITY OF SOME RUNOFF MODELS TO ERRORS IN RAINFALL EXCESS.
New Mexico Inst. of Mining and Technology, Socorro.
V. P. Singh.
Journal of Hydrology, Vol. 33, No. 3/4, p 301-318, 1977. 15 fig, 2 tab, 28 ref.

Descriptors: *Rainfall-runoff relationships, *Runoff, *Model studies, Watersheds (Basins), Hydrology, Mathematical models, Peak discharge, *Precipitation excess, Equations.
Identifiers: *Sensitivity analyses, Runoff models, Surface runoff hydrograph, Linear models, Nonlinear models.

Mathematical models describing the surface runoff hydrograph from a watershed can be classified as either linear or nonlinear. Linear models are used routinely because of their mathematical tractability, although it is recognized generally that watersheds are inherently nonlinear. This paper examined the sensitivity of predictions of runoff peak and its time by five linear and nonlinear surface runoff models to errors in rainfall excess. It was shown that if rainfall excess errors are sufficiently large, a perfectly identified nonlinear model does not perform always as well as an optimally identified linear model in predicting runoff peak, according to an objective function based upon fitting of runoff peaks. Thus, if one is not very confident in estimates of watershed infiltration, then in some circumstances linear models may have an advantage over nonlinear models in runoff peak predictions because they do not amplify the input errors. (Lee-ISWS)
W77-09339

FINITE-ELEMENT ANALYSIS OF GROUNDWATER FLOW IN MULTI-AQUIFER SYSTEMS. II. A QUASI THREE-DIMENSIONAL FLOW MODEL.
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W77-09362

TIDE-INDUCED RESIDUAL CURRENT-VERIFICATION OF A NUMERICAL MODEL.
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W77-09359

2B. Precipitation

THEORETICAL PROBABILITY DISTRIBUTION OF CRITICAL HYDROLOGIC EVENTS BY THE PARTIAL-DURATION SERIES METHOD.
Rome Univ. (Italy). Istituto di Costruzioni Idrauliche.
G. Calenda, A. Petaccia, and A. Togni.
Journal of Hydrology, Vol. 33, No. 3/4, p 233-245, 1977. 5 fig, 2 tab, 15 ref, 2 append.

Descriptors: *Precipitation (Atmospheric), *Flood peak, *Model studies, *Probability, Mathematical models, Mathematics, Stochastic processes, Statistical methods, Rainfall, Precipitation excess, Probable maximum precipitation, Equations, Rivers, Streamflow, Frequency curves, Hydrology.

Identifiers: *Partial-duration series methods, Polya stochastic process, Binomial distributions.

Precipitation or flood-peak exceedances usually are considered to occur in a Poisson stochastic process. The assumption is not always consistent with observed data, especially at high-exceedance probabilities. A better fitting model is the Polya stochastic process, which implies that each occurrence probability depends on previous events. The model yields a negative binomial distribution of the number of exceedances in a time interval. (Sims-ISWS)
W77-09109

THE FREEZING BEHAVIOUR OF SUPER-COOLED WATER DROPS.
University of Manchester Inst. of Science and Technology (England). Dept. of Physics.
For primary bibliographic entry see Field 2C.
W77-09118

THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK DISCHARGE FROM FOREST LAND.
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, J. C. Fortson, and G. B. Cunningham.
Water Resources Research, Vol 13, No 2, p 259-266, April 1977. 4 fig, 5 tab, 11 ref.

Descriptors: *Appalachian Mountain Region, *Rainfall intensity, *Peak discharge, Storm runoff, Rainfall, Forests, Forest watersheds, Precipitation intensity, Storms, Winter, Summer, Storm water.
Identifiers: *Forest land, Intensity variables, Storm rainfall classes, Storm magnitude.

Analysis of a 30-year record of rainfall and storm flow from a forested watershed in the southern Appalachians was made to determine whether rainfall intensity influenced storm flow volume or peak discharge per unit area. Hourly and minutely rainfall intensities during storms had no effect on storm flow volumes delivered by the basin. Storm rainfall P, antecedent flow I, season (winter or summer), and duration of the rainstorm D accounted for 86.4% of the total variation in the log of storm flow. Addition of maximum 60-, 30-, 15-, and 5-min intensities raised the variation to 86.7% but reduced the standard error by less than 1/2%. The same four variables (P, I, S, and D) accounted for 72% of the variation in the log of peak flow. Addition of the intensity variables raised the variation to 76.7%. Thus, only 4.7% of the total variation in the log of peak flow was attributable to intensity. Intensity played a much smaller role in peak discharge generation on the studied basin than was expected. The hypothesis was offered that rainfall intensity variation is not a dominant variable controlling flood generation in humid region, wild land watersheds. (Roberts-ISWS)
W77-09125

AN ASSESSMENT OF WATERSPOUT FREQUENCIES ALONG THE U.S. EAST AND GULF COASTS.
National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.
J. H. Golden.
Journal of Applied Meteorology, Vol 16, No 3, p 231-236, March 1977. 4 fig, 1 tab, 12 ref. NRC AT (49-25)-1004.

Descriptors: *Storms, *Tornadoes, *Coasts, *Southeast US, *Florida, Weather, Damages, Winds, Frequency analysis, Frequency, Spatial distribution, Statistics, Weather patterns, Meteorology, Florida.
Identifiers: *Waterspouts, Florida Keys, Tampa Bay (Fla).

Field 2—WATER CYCLE

Group 2B—Precipitation

Ship reports dating back to the 1880's and 'Storm Data' reports for the period 1959-1973 were used to assess the threat posed by waterspouts to existing and proposed floating offshore nuclear power plants along the U.S. East and Gulf Coasts. In particular, it was found that the primary warm axis of the Gulf Stream and large coastal bays and inland waterways are favored regions of waterspout occurrence. A list of the ten most active coastal regions, in terms of reported waterspouts per unit area, was synthesized. It was shown that the Florida Keys, the most prolific waterspout region is the entire southeast Florida Coast (Stuart to Homestead). Tampa Bay has had the greatest number of damaging waterspouts. (Sims-ISWS) W77-09130

PORTABLE AUTOMATED MESONET IN OPERATION,

National Center for Atmospheric Research, Boulder, Colo.
F. V. Brock, and P. K. Govind.
Journal of Applied Meteorology, Vol. 16, No. 3, p. 299-310, March 1977. 11 fig, 5 tab, 2 ref.

Descriptors: *Meteorological data, *Instrumentation, *Equipment, On-site investigations, Weather, Temperature, Humidity, Winds, Pressure, Rainfall, Measurement, Data transmission, Weather data, Radio communication systems, Sampling, Surveys, Meteorology.
Identifiers: *Data collecting systems.

Design highlights, system performance, and operational use of the Portable Automated Mesonet (PAM) were featured. PAM consists of a trailer-mounted base station and a network of remote sampling stations for surface mesoscale research. PAM differs from unautomated systems in that the data are sampled synchronously, averaged locally, and transmitted digitally via a telemetry link to the base station where real-time data from the entire network are displayed. The base station uses minicomputer control for polling remotes, logging data, checking data quality, and displaying data. Displays include tabular listings, time plots, vector wind plots, and contours. Remote stations measure pressure, temperature, humidity, rain, wind speed, and wind direction, and include flexibility for future expansion. A programmable microprocessor at each remote station controls communications, data sampling, and data averaging. Averaged data are reported to the base station when the base station interrogates the remote station (typically once a minute). System performance was evaluated in a group intercomparison experiment prior to field operation in support of the National Hail Research Experiment (NHRE '76). Real-time display of PAM was used to identify surface mesoscale circulations influencing thunderstorm development during NRE '76. (Sims-ISWS) W77-09131

EROSION CAUSED BY INTENSE RAINFALL IN A SMALL CATCHMENT IN NEW YORK STATE,

Clark Univ., Worcester, Mass. Graduate school of Geography.
For primary bibliographic entry see Field 2J.
W77-09134

AEROSOL OVER THE HIGH PLAINS OF THE UNITED STATES,

Washington Univ., Seattle. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 5A.
W77-09225

LIFE AT THE DESERT'S EDGE.

For primary bibliographic entry see Field 4C.
W77-09305

COMMENTS ON THE MECHANISM OF SOIL DETACHMENT BY RAINFALL,

Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 2G.
W77-09313

LABORATORY INVESTIGATION OF RAINFALL RETENTION AND TRANSMISSION IN FRESH SNOW,

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. P. Ebaugh, and D. R. DeWalle.
Technical Completion Report to National Weather Service, March 1977. 177 p, 15 fig, 11 tab, 6 ref. 4-36722.

Descriptors: *Rain, *Snow, Hydrology, Testing, Model studies, *Rainfall, *Retention, Water storage.
Identifiers: *Experimental data(Rainfall).

Hydrologic simulation models for routing liquid water through snow generally provide for both storage and routing of water within the snowpack. To provide data for such models, rain-on-snow experiments were conducted utilizing fresh snow samples in plexiglass cylinders. Measurements of rainfall quantity, rainfall temperature, snow depth, snow temperature, initial and final snow density, and snowpack out-flow were made during 44 rain-on-snow events conducted in a controlled temperature environmental chamber. Data collected for fresh snow were used to determine out-flow lag times, liquid-water-holding capacities, and routing coefficients. Results show outflow lag time to be a function of snow water equivalent and, to a lesser degree, initial snowpack temperature. Liquid-water-holding capacities were very low, ranging from zero to 5% by volume with an average value of 1%. Liquid-water-holding capacity was most highly correlated with initial snowpack density. Routing coefficients, defined as the fraction of water in transit released from a snowpack per time interval, decreased linearly in magnitude with liquid water content during the drainage portion of each run. Average routing coefficients for each rain-on-snow experiment varied from 0.0037 min⁻¹ to 0.152 min⁻¹ with an average value of 0.035 min⁻¹. (NOAA) W77-09322

PRECIPITABLE WATER VAPOR IN ATMOSPHERES CHARACTERIZED BY TEMPERATURE INVERSIONS,

Consiglio Nazionale della Ricerche, Bologna (Italy). Sezione Microfisica dell'Atmosfera.
C. Tomasi.
Journal of Applied Meteorology, Vol. 16, No. 3, p. 237-243, March 1977. 8 fig, 1 tab, 14 ref.

Descriptors: *Precipitation(Atmospheric), *Water vapor, *Air temperature, *Model studies, Mathematical models, Equations, Correlation analysis, Atmosphere, Humidity, Dew point, Temperature, Rainfall, Meteorology.

The total atmospheric precipitable water W was measured with an infrared hygrometer for different atmospheric conditions and for various seasons. Related to the simultaneous dew-point temperature T sub d at the surface, the data indicated that correct estimates of W can be given by the relationship $\ln W = a + b T$ sub d (first proposed by Reitan) only if properly chosen values for the intercept parameter a are used corresponding to the various periods of each day. The examination of both spectral hygrometer and radiosonde data taken in atmospheres characterized by marked temperature inversions showed that the parameter a is related closely to the ratio beta between the surface absolute humidity and W . On the other hand, the ratio appears to depend substantially on the general form of the vertical moisture profile of the low atmosphere. Thus, empirical relationships were proposed which give the

possibility of inferring from empirical values of beta estimates of the partial precipitable water content within low atmospheric layers and of the absolute humidity at some standard levels, when radiosonde data are not available. (Sims-ISWS) W77-09330

A SIMULATION OF SMOOTH-VARIABLE INTENSITY RAINFALL PATTERNS,

Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
J. F. Alfaro, and A. Y. Hachum.
Water Resources Bulletin, Vol. 13, No. 2, Paper No. 76101, p. 349-364, April 1977. 8 fig, 11 ref.

Descriptors: *Rainfall simulators, *Simulated rainfall, *Artificial precipitation, Infiltration, Runoff, Laboratory tests, Temporal distribution, Equipment, Laboratory equipment, Rainfall, Rainfall intensity, Erosion, Simulation analysis, Precipitation(Atmospheric), Sprinkling.
Identifiers: *Application patterns, Smooth variation, Watershed simulation.

Continuous rainfall patterns currently are simulated by approximating the patterns by stair-stepped (piece-wise) patterns. The effects of the approximation on infiltration and runoff processes are not well known. A new technique for simulating smooth-variable intensity rainfall patterns was presented. The technique is based on the fundamental principles of a moving water head in a container. The proposed technique is general and capable of simulating any rainfall pattern. However, as the rainfall pattern gets more complicated, the equipment required for simulation becomes more involved. The proposed technique was tested experimentally. A close agreement was found between the theoretical and experimental simulations. It was concluded that the proposed technique might be very useful in studying the infiltration and runoff processes under variable intensity rainfall, especially for simple convex patterns. (Sims-ISWS) W77-09337

PRECIPITATION LOADING OF ACID AND HEAVY METALS TO A SMALL ACID LAKE NEAR SUDBURY (ONTARIO),

Fisheries and Marine Service, Nanaimo (British Columbia). Biological Station.
For primary bibliographic entry see Field 5A.
W77-09353

ON THE CAUSES OF LOCAL CLIMATIC ANOMALIES, WITH SPECIAL REFERENCE TO PRECIPITATION IN WASHINGTON STATE,

Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
A. B. Pittcock.
Journal of Applied Meteorology, Vol. 16, No. 3, p. 223-230, March 1977. 5 fig, 2 tab, 44 ref.

Descriptors: *Precipitation(Atmospheric), *Topography, *Washington, *Australia, Climates, Climatology, Rainfall, Mountains, Lakes, Correlation analysis, Weather, Winds, Air circulation, Weather patterns, Air pollution, Fluctuations, Spatial distribution.

Topographic effects on climate, and particularly on precipitation, are well known in the literature. Nevertheless, the separation on the mesoscale of topographic effects from possible anthropogenic effects has proved difficult. A method based on patterns of correlation between local climate elements and indices of the general circulation, which was developed in a study of Australian rainfall, was applied to precipitation in the State of Washington and surrounding areas where relief is much greater. Patterns were found which account for the major part of some climatic anomalies discussed in the literature and which have previ-

ously been ascribed to anthropogenic effects. The wider implications for the study of urban and other anthropogenic effects was discussed with reference to the La Porte anomaly and METROMEX. (Sims-ISWS)
W77-09355

A SIMPLE CONTINUOUS ICE CRYSTAL REPLICATOR FOR USE IN LABORATORY CLOUD CHAMBERS.
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
E. R. Wishart.
Journal of Applied Meteorology, Vol. 16, No. 3, p 317-318, March 1977. 2 fig, 10 ref.

Descriptors: *Cloud physics, *Instrumentation, *Sampling, Ice, Crystals, Laboratory tests, Equipment, Precipitation (Atmospheric), Meteorology.
Identifiers: *Cloud chambers, *Ice crystal replicators, Samplers.

By means of the Schaefer 'wet slide' method, applied to a standard 7.5 cm x 2.5 cm glass slide, an inexpensive, continuous ice crystal replicator was developed, which produces replicas of good quality for sampling times of up to 3 min, with a time resolution approaching + or - 5 s. (Sims-ISWS)
W77-09360

A SUGGESTED TECHNIQUE FOR THE ANALYSIS OF AIRBORNE CONTINUOUS ICE NUCLEUS DATA.
Montana State Univ., Bozeman. Dept. of Earth Sciences.
For primary bibliographic entry see Field 3B.
W77-09361

A PORTABLE RAINFALL SIMULATOR FOR ERODIBILITY AND INFILTRATION MEASUREMENTS ON RUGGED TERRAIN.
Klamath National Forest, Yreka, Calif.
For primary bibliographic entry see Field 2J.
W77-09441

2C. Snow, Ice, and Frost

PLEISTOCENE ICE AT THE BASE OF THE BARNES ICE CAP, BAFFIN ISLAND, N.W.T., CANADA.
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
R. LeB. Hooke.
Journal of Glaciology, Vol. 17, No. 75, p 49-59, 1976. 6 fig, 2 tab, 18 ref. NSF GA-19310, GA-42728.

Descriptors: *Canada, *Glaciation, *Ice, *Pleistocene epoch, Glaciology, On-site investigations, *Isotope studies, Oxygen isotopes, Glaciers, Movement, Mathematical models, Analytical techniques, Analysis, On-site data collections, Evaluation, Ablation, Velocity, Temperature.
Identifiers: *Baffin Island (Canada), *Barnes Ice Cap (Canada), Ice Cap.

Oxygen-isotope ratios indicate that a distinctive band of white ice along the margin of the Barnes Ice Cap is of Pleistocene age. It was estimated from a flow model that beneath the center of the ice cap the thickness of the band should be about 0.6 times its thickness at the margin, or about 8 m. However, an independent estimate, based on calculated lateral strain-rates and explicitly assuming no basal melting, predicts a thickness of about 22 m beneath the center of the ice cap. The discrepancy between the two thickness estimates was interpreted as indicating that basal melting has occurred. Calculated basal temperatures support the conclusion. (Humphreys-ISWS)
W77-09116

ICE AND OCEAN TILT MEASUREMENTS IN THE BEAUFORT SEA.
Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
J. R. Weber, and M. Erdelyi.
Journal of Glaciology, Vol. 17, No. 75, p 61-71, 1976. 6 fig, 12 ref, 1 append.

Descriptors: *Sea ice, *Slopes, *Sea levels, *Oceans, *Measurement, On-site investigations, On-site tests, On-site data collections, Instrumentation, Water levels, Floating, Hydraulics, Evaluation, Analysis, Theoretical analysis, Ice.
Identifiers: *Beaufort Sea, *Ice tilt measurement.

During the AIDJEX pilot study of 1972 in the Beaufort Sea, the tilt changes of the fluid ocean surface and of the sea ice were measured with a hydrostatic level. Preliminary results indicated a tilt range of + or - 5 microradians for the water surface and of + or - 30 microradians for the sea ice. The tilt change of the sea ice appears to be directly proportional to the component of the velocity change of the ice drift parallel to the hydrostatic level. It was concluded that the ice tilt is wind induced, and that the ice sheet tilts downward in the drift direction as a result of the moment exerted on it by wind and water drag. It was postulated that the tilt causes the ice to break at right angles to the drift direction. The tilt is a function of the length of an ice floe (or of the unbroken distance between two cracks), of the average ice thickness, of the average drag coefficients, and of wind and current velocities. Calculation of the ice tilt using a simple model of a floating, rigid ice slab gives values which are very much smaller than the observed tilts. If the discrepancy between theory and observation can be resolved, or if an empirical formula between wind velocity and tilt angle can be deduced from continuous tilt observations which will be carried out during the AIDJEX main experiment, it will be possible, for a given wind, to estimate the maximum length of an unbroken ice sheet from its estimated thickness, its drag coefficients, and its tensile strength. It should also be possible to calculate the average drag coefficients of a free-floating ice pan, or of an ice island, from tilt, wind, and current measurements. The curious relationship between tilt angle and atmospheric pressure gradient that Browne and Cray observed on the ice island T-3 in 1952 was explained as being the wind-induced tilt of the ice island rather than that of the fluid ocean surface. (Humphreys-ISWS)
W77-09117

THE FREEZING BEHAVIOUR OF SUPER-COOLED WATER DROPS.
University of Manchester Inst. of Science and Technology (England). Dept. of Physics.
M. J. Gay, and J. Latham.
Journal of Glaciology, Vol. 17, No. 75, p 99-109, 1976. 5 fig, 1 tab, 12 ref. NERC GR3/2425.

Descriptors: *Freezing, *Cloud physics, *Drops (Fluids), *Laboratory tests, Precipitation (Atmospheric), Nucleation, Ice, Glaciation, Equipment, Data collections, Evaluation, Supercooling, Supersaturation.

An electrodynamic containment system was used to study the freezing behavior of supercooled water drops, of radius range 25 to 90 micrometer. The drops were frozen at temperatures between 0 and 29°C in an environment whose relative humidity was approximately 90% with respect to ice. Freezing events were observed visually and photographically, and measurements were made of the accompanying fractional mass loss. The most common mode of freezing (70% of the drops studied) resulted in an apparently spherical ice particle. However, 18% exhibited spikes or other protuberances, and the freezing of 3% was accompanied by the ejection of numerous ice particles. In each situation, values of fractional mass loss ranged from about 5 to 15%. A further 9% of the drops exhibited one or more secondary mass-loss

events, occurring several seconds after the freezing process was complete, which is indicative of the ejection of ice particles. Almost all of the values of fractional mass loss were significantly in excess of those predicted on the basis of evaporation during freezing, suggesting that an additional mechanism of mass loss also was present. The measured freezing times were considerably shorter than the classical values-at least, for the larger drops freezing at warmer temperatures. (Humphreys-ISWS)
W77-09118

THE FREEZING OF SMALL TYNDALL FIGURES IN ICE.
Nagoya Univ. (Japan). Water Research Inst.
S. Mae.
Journal of Glaciology, Vol. 17, No. 75, p 111-116, 1976. 6 fig, 4 ref.

Descriptors: *Crystal growth, *Ice, *Crystallography, *Laboratory tests, *Freezing, Crystals, Melting, Testing procedures, Anisotropy, Measurement, Evaluation.
Identifiers: *Tyndall figures (Ice).

Tyndall figures, small thin discs of liquid water containing a vapor cavity, were formed in the centers of grains of pure, polycrystalline ice and were observed while freezing and growing. The freezing experiments showed, that the rate of decrease in the radius of a Tyndall figure does not depend upon the radius of the figure but does depend upon the thickness, h . Below a transition thickness of 12 micrometers, the rate of decrease of the radius varied inversely with h squared; above the transition thickness, the radius rate of decrease varied with $1/h$. For growing figures, the transition thickness was approximately 10 micrometers and was defined in such a way that for h greater than the transition thickness, perturbations with wavelengths greater than 100 micrometers formed on the side faces of the Tyndall figures. (Humphreys-ISWS)
W77-09119

RIDGES ON ANTARCTIC ICE RISES.
British Antarctic Survey, Cambridge (England).
P. J. Martin.
Journal of Glaciology, Vol. 17, No. 75, p 141-144, 1976. 4 fig, 7 ref.

Descriptors: *Ice, *Antarctic, *Topography, *Model studies, Glaciology, Flow, Deformation, *Remote sensing, On-site investigations.
Identifiers: *Larsen ice shelf, *Spaatz Island, Ice rise, Sand model.

Satellite pictures have revealed the presence of ridges on the summits of ice rises in Antarctica. Because ice does not exhibit a critical stress, it was concluded that the ridges must be produced by a snow accumulation process rather than by ice deformation. A sand-model analog was used to simulate this behavior. The existence of a ridge on an ice rise will produce an increase in the shear stress below it, which in turn will tend to flatten the surface profile. Thus, unlike the sand model, the normal flow behavior of the ice will tend to spread the surface ridge, so producing the very shallow slopes observed. (Humphreys-ISWS)
W77-09120

EXTRACTION OF TRACE COMPONENTS FROM LARGE QUANTITIES OF ICE IN BORE HOLES.
Bern Univ. (Switzerland). Physikalisches Institut.
H. Oeschger, B. Stauffer, P. Bucher, and M. Moell.
Journal of Glaciology, Vol. 17, No. 75, p 117-128, 1976. 4 fig, 1 tab, 11 ref.

Descriptors: *Ice, *Borehole geophysics, Dating, *Sampling, Polar regions, *Boreholes, Instrumentation, *Radioactive dating, Drill holes, Core

Field 2—WATER CYCLE

Group 2C—Snow, Ice, and Frost

drilling, Testing procedures, Melting, On-site investigations, Equipment, Heating, Separation techniques, ³Isotope studies.

A melting probe system was developed which can be lowered down to 400 m in an ice borehole of 135-165 mm diameter. At the desired depth, a section of the borehole is isolated and evacuated. Afterwards, several tons of ice are melted under vacuum with an electrical heater. The inclusions, which are principally gaseous, may be collected both during or after the melting procedure. The application of this system is mainly in the field of dating polar ice by radio-active isotope analysis. The devices used for sampling included a melting probe, a balloon probe, submersible pump, cable hose and auxiliary hoses, winches for cable hose and auxiliary hoses, gas control system, and the electrical power system. Each device was described. (Humphreys-ISWS)
W77-09121

A METHOD OF CONCENTRATING THE MAJOR IMPURITIES CONTAINED IN ICE BY ION EXCHANGE.
Grenoble-1 Univ. (France). Institut de Geographie Alpine.
M. Ricq-de Bouard.
Journal of Glaciology, Vol. 17, No. 75, p 129-133, 1976. 1 fig, 1 tab, 9 ref.

Descriptors: *Ice, Sampling, Testing procedures, *Analytical techniques, Snow, Glaciers, *Ion exchange, *Sodium, *Potassium, *Calcium, *Magnesium, Analysis, Laboratory tests, Cations, *Flame photometry, Methodology, Pollutant identification.
Identifiers: Atomic absorption.

This note described a method for concentrating Na, K, Ca, and Mg impurities in samples of snow and ice for analysis by atomic absorption in flame photometry. The cations are fixed on a Dowex 50 ion-exchange resin and then selectively released and separately analyzed by atomic absorption. The described method allows the simultaneous treatment of a large number of specimens with concentration factors which can reach 60 to 75 and with very low risk of contamination or loss of the specimens. (Humphreys-ISWS)
W77-09122

ON THE USE OF TENSIOLOGICALS IN SNOW HYDROLOGY.
Cold Regions Research and Engineering Lab., Hanover, N.H.
S. C. Colbeck.
Journal of Glaciology, Vol. 17, No. 75, p 135-140, 1976. 4 fig, 11 ref. Army 4A161102B52E/02/011.

Descriptors: *Tensiometers, *Snow, *Ice, *Water pressure, *Arctic, Hydrology, Snowpacks, Glaciers, Moisture tension, Tension, Instrumentation, Measurement, Equipment, Mechanical properties, Water, On-site tests, Percolating water.

The construction and use of snow water tensiometers were described. Water pressure at the base of a shallow, Arctic snowpack was measured to illustrate the response of the basal layer to water percolation. Water tension above an ice layer and water flux through the ice layer were measured in glacial snow. The gravity flow theory was used to explain the close agreement between the parameters. The theory suggests that the ice layer has little effect on the flow field and that gravity (rather than tension gradients) controls the flow. Further work on water tensions is needed to identify the role of tension gradients in ripening and shallow snow covers. (Humphreys-ISWS)
W77-09123

PLEISTOCENE GLACIATION IN ETHIOPIA: NEW EVIDENCE.
Oregon State Univ., Corvallis. Dept. of Geology.
E. C. Potter.

Journal of Glaciology, Vol. 17, No. 75, p 148-150, 1976. 1 fig, 8 ref.

Descriptors: *Glaciation, *Africa, *Glacial drift, Pleistocene epoch, Geomorphology, Mountains, Valleys, Foreign countries.
Identifiers: *Ethiopia, *Mount Badda(Ethiopia).

Geomorphological evidence indicates that Mount Badda, Ethiopia, had a Pleistocene ice cap of at least 140 sq km. Altitude of the snow line was probably about 4000 m, only 350 m below the summit, suggesting that glaciation occurred during the Wurm glacial maximum. (Humphreys-ISWS)
W77-09124

RESEARCH PROJECTS IN GLACIOLOGY - 1976.
Department of the Environment, Ottawa (Ontario). Water Resources Branch.
Report Series No 49, 1977. 136 p, 168 ref, 9 photos.

Descriptors: *Research and development, *Glaciers, Erosion, Instrumentation, Remote sensing, Ice, Climatology, Oil, Pipelines, Watersheds(Basins), Snowpacks, Satellites, Melt water, Oil pollution, *Canada, *Surveys, *Bibliographies.
Identifiers: Project catalogue, *Arctic hydrology, *Ice properties, *Avalanche research, *Glacier mapping, Baffin Island, Mackenzie Basin, Northwest Territories, Mass balance, Dendroclimatology.

The principal objective of the Glaciology Division, Environment Canada, is to maintain within Canada a center of expertise in snow and ice, particularly in relation to inland water resources. This includes the establishment of an inventory of the perennial snow and ice masses and their changes from year to year; studies of Arctic hydrology; studies of lake and river ice; of the role of snow and ice in hydrology; of the fundamental properties of these materials and of avalanche problems. Increased attention is being given to applied studies, the results of which can be used operationally in water management projects or in the Environmental Review and Assessment process. The structure and organization of the Glaciology Division are described and the general objectives and responsibilities of each of its components are presented. The catalog section provides details of work done on projects since publication of the 1974 report. Projects which have been terminated, transferred, suspended or absorbed into other studies are listed separately. A bibliography of 168 published material not contained in previous reports is included. (WATDOC)
W77-09220

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965 - 1974. NO. 1. SENTINEL GLACIER, BRITISH COLUMBIA - SUMMARY OF MEASUREMENTS.
Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch.
O. Mokievsky-Zubok, and A. D. Stanley.
Scientific Series No. 68, 1976. 75 p, 1 fig., 1 tab, 47 ref, 29 maps.

Descriptors: *Glaciers, *Glaciology, Hydrology, Hydrography, *Measurement, Geology, Meteorology, Mass, Rating curves, Parametric hydrology, Surface drainage, Elevation, Mountains, Melt water, *Data collections, *Canada.
Identifiers: *Sentinel Glacier, *British Columbia, Net mass balance, Winter balance, Summer balance.

Sentinel Glacier, located in the Coast Mountain Range of British Columbia, is one of five glaciers studied in Western Canada as part of the Canadian contribution to the International Hydrological Decade (IHD). Studies began in 1966. The report

describes the main parameters of the glacier, the geology of the basin and gives summaries of glaciological, meteorological and hydrological data collected until the end of 1974 field season, together with a bibliography and references to special studies of the glacier. (WATDOC)
W77-09222

PREDICTING SNOW DEPTHS ON A MOUNTAIN WATERSHED.
Colorado State Univ., Fort Collins. Dept. of Fishing and Wildlife Biology.
L. H. Stelter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 363, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, Spring 1975. 50 p, 12 fig, 2 tab, 65 ref. OWRT A-019COLO(1). 14-31-0001-5006.

Descriptors: Snow, Forecasting, Depth, Watershed management, Data collections, *Colorado, Measurement, Model studies, Regression analysis, Snowmelt.
Identifiers: *Snow depth prediction, Mountain watersheds(Colo), *Missionary Ridge watershed(Colo).

The Missionary Ridge watershed on the western slope in southwestern Colorado was studied to determine if accurate predictions of snow depth with respect to elevation could be made, using wide ranges of the variables aspect, percent slope, and vegetative type to classify snow measurement sites. Data were collected for the winters of 1971-72, 1972-73, and 1973-74, using a total of 19 snow stake stations over an elevational range of 2300-3500 meters (7500-11,500 ft). The stations were placed in one of two groups; the groups were separated by differences in aspect, vegetative type, and ranges in percent slope. A simple linear regression model was used to try to explain the changes in snow depth with changes in elevation through the snow period for each of the two groups of stations. Predictions were fairly accurate each time the snow depths were measured, but the slopes of the regression lines were rather drastically different when the snow depth at a particular snow station was the same both between years and at different times of the same year. It was concluded that the major variables affecting snow accumulation and melt were too generally accounted for in this study to be of use in predicting snow depth over the entire watershed.
W77-09257

LACUSTRINE SEDIMENTS IN THE ALLEGHENY PLATEAU OF ERIE COUNTY, NEW YORK: THEIR CHARACTERISTICS, DISTRIBUTION, AND LAND USE PROBLEMS.
Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.
For primary bibliographic entry see Field 2J.
W77-09357

THE WINTER DARK SURVIVAL OF AN ALGAL FLAGELLATE-CRYPTOMONAS EROSA (SKUJA).
For primary bibliographic entry see Field 5C.
W77-09482

EFFECT OF CRUDE OIL ON POPULATIONS OF BACTERIA AND ALGAE IN ARTIFICIAL PONDS SUBJECT TO WINTER WEATHER AND ICE FORMATION.
For primary bibliographic entry see Field 5C.
W77-09526

2D. Evaporation and Transpiration

AUGMENTING SUMMER STREAMFLOW BY USE OF A SILICONE ANTITRANSPIRANT.
Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.

For primary bibliographic entry see Field 3B.
W77-09126

EVAPORATION AND EVAPOTRANSPIRATION IN NIGERIA,
J. O. Ayode.
Journal of Tropical Geography, Vol. 43, p 9-19,
December, 1976, 10 fig, 3 tab, 19 ref.

Descriptors: *Evaporation, *Evapotranspiration, *Evaporimeters, *Africa, *Meteorological data, *Moisture availability, *Measurement, Hydrology, Climatology, Soil moisture, Evaporation control, Rainfall, Evaporation pans, Correlation analysis, Precipitation (Atmospheric), Meteorology.
Identifiers: *Potential evapotranspiration, *Nigeria.

Evaporation and evapotranspiration are difficult to measure. In Nigeria routine measurements of evaporation did not begin in most parts of the country until the late 1950s. An overview is given of the various methods used to measure evaporation and some of the problems encountered. An attempt has been made using correlation analysis to assess the relative influence of some meteorological factors on measured evaporation in Nigeria. Due to the high costs associated with measuring evapotranspiration in the field, it is sometimes estimated indirectly from meteorological data. This is discussed; the formulae designed to estimate evapotranspiration can also be used to estimate potential evapotranspiration. The effectiveness of using the Thornthwaite or the Penman formula or estimating potential evapotranspiration is also discussed. (Jamal-Arizona)
W77-09299

ESTIMATED EVAPOTRANSPIRATION AND IRRIGATION REQUIREMENTS FOR CITRUS,
Florida Univ., Gainesville. Inst. of Food and Agricultural Science.
J. S. Rogers, and J. F. Bartholic.
Soil and Crop Science Society of Florida Proceedings, Vol 35, p 112-117, Nov 1975. 2 fig, 4 tab, 2 ref. OWRT A-031-FLA(1). 14-34-0001-6010.

Descriptors: *Evapotranspiration, *Evaporation, Lake evaporation, Water management (Applied), Bowen ratio, Turbulent flux, Water balance, Rainfall, Soil water, Holding capacity, *Irrigation practices, *Water requirements, Crop production, Forecasting, Estimating, *Citrus.

Research data for water requirements of crops in Florida are limited. With the advent of water use permitting, it is imperative that techniques be available to reliably predict water requirements of crops. In this study a modified Blaney-Criddle procedure for estimating evapotranspiration (ET) for citrus was compared with research data of Robert Koo. The Blaney-Criddle technique gave the same ET values as the research data. Net irrigation requirement was calculated by a procedure developed by the Soil Conservation Service and compared with a daily water balance. Again comparable results were obtained. The ET estimates for citrus vary little within the state. Thus irrigation requirements depend upon amount of rainfall, rainfall distribution, and soil storage. Less rainfall usually results in higher irrigation requirements, but even in a high rainfall year considerable irrigation may be needed because of poor rainfall distribution. As soil storage decreases, larger amounts of irrigation are needed. Also as the crop ET increases, irrigation requirements will increase. (Morgan-Fla)
W77-09406

THE AQUATIC THERMAL CAPSULE,
Southern Illinois Univ. at Carbondale. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-09486

ELEVATED SUCTION TENSIONS AND MORPHOLOGICAL ALTERATIONS CAUSED BY TRANSVERSE CUTS IN A TAXUS STEM, (IN GERMAN),
Hochschule fuer Bodenkultur, Vienna (Austria). Botanisches Institut.
For primary bibliographic entry see Field 2I.
W77-09530

2E. Streamflow and Runoff

THEORETICAL PROBABILITY DISTRIBUTION OF CRITICAL HYDROLOGIC EVENTS BY THE PARTIAL-DURATION SERIES METHOD,
Rome Univ. (Italy). Istituto di Costruzioni Idrauliche.
For primary bibliographic entry see Field 2B.
W77-09109

CRITERION TO CHOOSE STEP LENGTH FOR SOME NUMERICAL METHODS USED IN HYDROLOGY,
New Mexico Inst. of Mining and Technology, Socorro.
V. P. Singh.
Journal of Hydrology, Vol. 33, No. 3/4, p 287-299, 1977. 3 fig, 4 ref.

Descriptors: *Model studies, *Numerical analysis, *Analytical techniques, *Hydrology, Mathematics, Mathematical models, Equations, Diffusion, Rainfall, Runoff, Rainfall-runoff relationships, Finite element analysis.
Identifiers: *Step errors, Numerical methods, Differential equations.

An analytical treatment was given for the step error of some numerical methods frequently used in hydrology. Such a treatment is then utilized to formulate a criterion to choose the step length a priori that will guarantee convergence, stability, and minimum error production for the numerical method. (Sims-ISWS)
W77-09110

OPTIMAL FILTERING TECHNIQUES FOR HYDROLOGICAL FORECASTING,
Public Power Corp., Athens (Greece).
A. H. Maissis.
Journal of Hydrology, Vol 33, No 3/4, p 319-330, 1977. 3 fig, 14 ref.

Descriptors: *Inflow, *Reservoirs, *Forecasting, *Model studies, Mathematical models, Time series analysis, Analytical techniques, Regression analysis, Mathematics, Runoff, Streamflow, Hydrology.
Identifiers: *Inflow forecasting, Autoregressive models.

Two important aspects of linear prediction theory were outlined: time series forecasting and dynamic system identification. In both cases, the estimation of a parametric model is involved. The model parameters were computed by an iterative method based on Kalman's optimal filtering technique. Using Kalman's method, a model was fitted to the time series representing the monthly water inflows to a reservoir of the Greek hydroelectric system. Short- and medium-term forecasts of good accuracy then were computed. The confidence limits of the forecasts were determined by combining the results of the presented method and those obtained by pure statistical analysis of the data. (Sims-ISWS)
W77-09111

THE CALIBRATION OF SHARP CRESTED WEIRS BY THE PONDAGE DRAWDOWN METHOD,
Sheffield Univ. (England). Dept. of Civil and Structural Engineering.
For primary bibliographic entry see Field 8C.

W77-09113

THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK DISCHARGE FROM FOREST LAND,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 2B.
W77-09125

AN OPERATIONAL APPROACH TO PRESERVING SKEW IN HYDROLOGIC MODELS OF LONG-TERM PERSISTENCE,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-09127

DEVELOPMENT OF THE SPRING CREEK DATA ACQUISITION SYSTEM,
Montana State Univ., Bozeman. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 7A.
W77-09258

PREDICTING STORMFLOW AND PEAKFLOW FROM SMALL BASINS IN HUMID AREAS BY THE R-INDEX METHOD,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 4A.
W77-09334

SENSITIVITY OF SOME RUNOFF MODELS TO ERRORS IN RAINFALL EXCESS,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2A.
W77-09339

BAYESIAN GENERATION OF SYNTHETIC STREAMFLOWS, 2. THE MULTIVARIATE CASE,
Simon Bolivar Univ., Caracas (Venezuela).
J. B. Valdes, I. Rodriguez-Iturbe, and G. J. Vicens.
Water Resources Research, Vol. 13, No. 2, p 291-295, April 1977. 3 tab, 9 ref, 1 append. NSF GK-41643X.

Descriptors: *Streamflow, *Synthetic hydrology, *Regression analyses, *Stochastic processes, *Analytical techniques, *New Hampshire, Statistics, Risks, Probability, Hydrologic data, Computers, Methodology, Model studies.
Identifiers: *Bayesian method, *Prior distribution, Multivariate model.

Presented herein was a multivariate extension of the model for generating annual flows with the use of Bayesian methods to account for the parameter uncertainties due to short hydrologic records. The Bayesian multivariate regression model uses informative prior probability distribution function to include additional information about the unknown parameters of the stochastic streamflow process. The methodology was applied to three watersheds in New Hampshire. The results showed that the proposed method produces synthetic traces with higher standard deviations than the historical sample when the historical record is very short, which accounts for the uncertainty about the time value of the parameters and allows the planner to evaluate alternative projects in view of the mentioned uncertainty. (See also W76-05271) (Singh-ISWS)
W77-09349

THE USE OF THE PEARSON TYPE 3 AND LOG PEARSON TYPE 3 DISTRIBUTIONS REVISITED,
National Inst. of Scientific Research, Quebec.
B. B. Bobee, and R. Robitaille.

Field 2—WATER CYCLE

Group 2E—Streamflow and Runoff

Water Resources Research, Vol. 13, No. 2, p 427-443, April 1977. 1 fig, 19 tab, 15 ref.

Descriptors: *Flood frequency, *Probability, *Analytical techniques, *Distribution, *Methodology, Hydrologic data, Annual flood, Gaging stations, Drainage area, Equations. Identifiers: *Pearson type 3 distribution, *Method of maximum likelihood, Homogeneity tests, Method of moments.

Different methods of fitting the Pearson type 3 and log Pearson type 3 distributions were applied to several long-term records of annual flood flow after testing for independence and homogeneity. With the exception of one drainage basin, the test drainage areas ranged from 17 to 578,000 sq km. The method of maximum likelihood was shown to lead to generally poor results for small samples as used in hydrology. The Pearson type 3 distribution was shown to fit the annual flood data more adequately than the log Pearson type 3 distribution for the drainage areas tested. The bias of the coefficient of skewness computed by the method of moments was necessary. (Singh-ISWS) W77-09352

2F. Groundwater

GROUNDWATER RESOURCES OF AUSTRALIA.

Australian Water Resources Council, Canberra. For primary bibliographic entry see Field 4B. W77-09103

THE AGE OF GROUNDWATER IN THE LINCOLNSHIRE LIMESTONE, ENGLAND AND ITS RELEVANCE TO THE FLOW MECHANISM.

Department of the Environment, Reading (England), Central Water Planning Unit. R. A. Downing, D. B. Smith, F. J. Pearson, R. A. Monkhouse, and R. L. Olet. Journal of Hydrology, Vol. 33, No. 3/4, p 201-216, 1977. 3 fig, 2 tab, 14 ref.

Descriptors: *Groundwater, *Age, *Chemical properties, Groundwater movement, Limestones, Isotope studies, Carbon, Oxygen, Tritium, Deuterium, Sulphates, Nitrates, Bicarbonates, Calcium carbonate, Radiochemical analysis, Geology, Hydrogeology. Identifiers: *England, *Groundwater age.

Groundwater samples from the Lincolnshire Limestone were analyzed for tritium, radiocarbon, and the stable-isotope ratios $^{13}\text{C}/^{12}\text{C}$, $^{18}\text{O}/^{16}\text{O}$ and D/H . The age of the water increases in a downgradient direction below overlying confining deposits and reaches a maximum age greater than 25,000 years within 15 km of the out-crop. The delta ^{13}C ratio ultimately attains the unusually low negative values of -2 parts per thousand in a downgradient direction; this is approaching that of the aquifer matrix which is +2.35 parts per thousand. The reason is believed to be exchange of carbon between the groundwater and the matrix by a continuous process of precipitation and further solution of calcium carbonate. The delta ^{18}O and delta D ratios imply that recharge of the aquifer during the late Pleistocene took place in the spring and autumn rather than the winter as at present. The data were interpreted by assuming that movement of water through the saturated zone is a combination of flow in fissures and 'piston flow' through the micro-fissures and pores of the rock. The mechanism of water movement in the saturated zone is dominated by relatively rapid flow in fissures, but the fissure flow includes a contribution of much older water from 'intergranular' storage which enters the fissures from the rock matrix by pressure differentials in the fissure distribution system and by diffusion. The distribution of water of different ages in the aquifer is related closely to recent groundwater abstraction patterns. (Sims-ISWS) W77-09107

RECHARGE TO BUNTER SANDSTONE DETERMINED FROM LYSIMETERS.

Institute of Geological Sciences, London (England). Dept. of Hydrogeology. R. Kitching, T. R. Shearer, and S. L. Shedlock. Journal of Hydrology, Vol. 33, No. 3/4, p 217-232, 1977. 5 fig, 4 tab, 13 ref.

Descriptors: *Groundwater, *Groundwater recharge, *Lysimeters, *Sandstones, Measurement, Precipitation (Atmospheric), Rainfall, Evaporation, On-site investigations, Equations, Infiltration, Groundwater movement, Moisture content, Vegetation, Vegetation effects, Hydrogeology. Identifiers: *England.

The results of three years operation of two large natural grassed lysimeters on Bunter Sandstone were described. Recharge measured each year by both of the lysimeters was greater than that calculated using rainfall, evaporation estimates, and a root constant of 75 mm. The mean measured recharge indicated that the calculated 'actual evaporation' may be 13% too high. A value of root constant of 35-50 mm seems appropriate for short grass in this area. The results highlighted the inadequacy of the 'rainfall less evaporation' calculation as a means of determining recharge within reasonable limits in areas where rainfall and evaporation are of the same order such as in the groundwater areas of the U. K. or semi-arid areas of the world. (Sims-ISWS) W77-09108

VALIDATION OF AN AXISYMMETRIC PSEUDO-UNCONFINED TIME-VARIANT DIGITAL MODEL.

Birmingham Univ. (England). Dept. of Mechanical Engineering. Y. K. Chan. Journal of Hydrology, Vol. 33, No. 3/4, p 331-340, 1977. 1 fig, 4 tab, 18 ref.

Descriptors: *Aquifers, *Groundwater, *Pumping, *Model studies, Mathematical models, *Computer models, Groundwater movement, Water levels, Drawdown, Wells, Water wells, Analytical techniques, Hydrology. Identifiers: Time-variant models.

The use of an axisymmetric pseudo-unconfined pumping-test digital model to simulate intergranular flow in an unconfined aquifer, due to a single-well pumping at a constant rate, was justified theoretically. The digital model was further validated by comparison with known steady-state case studies and a time-variant analytical solution. The computational effort required for the digital model was small. (Sims-ISWS) W77-09112

NON-PENETRATING WELL IN A SEMI-INFINITE MEDIUM WITH NON-LINEAR FLOW.

Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering. P. Basak. Journal of Hydrology, Vol. 33, No. 3/4, p 375-382, 1977. 4 fig, 2 tab, 17 ref.

Descriptors: *Penetration, *Water wells, *Steady flow, Mathematical models, Equations, Darcys law, Aquifers, Groundwater movement, Velocity, Reynolds number, Turbulent flow, Coarse sediments, Hydraulic gradient, Viscosity, Potentiometric level, Well spacing, Discharge. Identifiers: *Non-penetrating wells, Non-linear flow, Inertial forces, Analytical solutions.

A steady-state analytical solution for the case of a non-penetrating well in a semi-infinite medium incorporating Forchheimer's non-linear velocity-gradient response was presented. The solution was compared with the available solution for Darcian linear flow. The effect of non-linearity in the flow response on the discharge characteristics and

piezometric pressure distribution in relation to the corresponding linear case was brought out. (Visocky-ISWS) W77-09114

PROFILE DESATURATION DURING SEDIMENT DEPOSITION IN A GROUNDWATER RECHARGE TRENCH.

Mississippi Agricultural and Forestry Experiment Station, Mississippi State. Dept. of Agronomy. For primary bibliographic entry see Field 4B. W77-09115

DECLINING POTENTIOMETRIC LEVELS IN FORT WALTON BEACH AREA, FLORIDA.

Northwest Florida Water Management District, Tallahassee. For primary bibliographic entry see Field 4B. W77-09132

TRANSFORM APPROACH TO SOLUTION OF GROUNDWATER FLOW EQUATIONS.

Nevada Univ., Reno. Water Resources Center; and Nevada Univ., Reno. Desert Research Inst. C. M. Case, and M. K. Peck. Journal of Hydrology, Vol. 32, No. 3/4, p 305-320, February 1977. 6 tab, 12 ref. OWRT A-059-NEV(3).

Descriptors: *Numerical analysis, *Mathematical models, *Potential flow, *Analytical techniques, Groundwater, Equations, Aquifers, Porous media, Hydrodynamics, Computer models. Identifiers: *Fourier transforms, Partial differential equations, Integral equations.

A method of obtaining approximate integral transforms of second-order partial differential equations with non-constant coefficients was discussed. The inverses of these transforms may be found by using the appropriate standard inversion techniques. Finite and infinite Fourier transforms were discussed as particular cases. The application of these transforms to groundwater flow equations was discussed briefly via two examples. The potential advantages of this technique for application to numerical solution of flow equations and diffusion-dispersion equations are: (1) for each independent variable that can be transformed, a dimension that would otherwise need to be considered numerically is eliminated, thus making larger problems accessible to computer analysis; and (2) the solution can be generated at the spatial and temporal locations of interest only, thus effecting further efficiencies in modeling a given aquifer system. (Adams - ISWS) W77-09318

HYDROLOGY OF TWO SMALL WETLAND BASINS IN EASTERN MASSACHUSETTS.

Lowell Univ., Mass. Dept. of Earth Sciences. For primary bibliographic entry see Field 2A. W77-09336

TYPE CURVES FOR RECOVERY OF A DISCHARGING WELL WITH STORAGE.

Nevada Univ. System, Reno. Water Resources Center. P. R. Fenske. Journal of Hydrology, Vol. 33, No. 3/4, p 341-348, 1977. 3 fig, 7 ref.

Descriptors: *Wells, *Georgia, *Groundwater, Groundwater movement, Theis equation, Hydrology, Transmissivity, Discharge (Water), Analysis, Equations, Mathematical studies, On-site investigations. Identifiers: *Type curves, Recovery type curves.

The analysis of water level recovery data usually is carried out using the straight line or late time solution. Recently, Case et al presented a method based upon the reversion of the series representing

the exponential integral whereby recovery data could be analyzed if only two points were known on the recovery curve. The analysis was based upon the Theis equation and, consequently, was subject to all of the assumptions to the Theis equation. The most important of these assumptions is the lack of storage in the discharging well. Papadopoulos and Cooper solved the problem and presented appropriate type curves for well recovery after instantaneous charge of water when the well contained storage. Fenske presented an extension of the Theis equation which considers both discharging and observation well storage. The simpler mathematics makes the derivation of type recovery curves for radial flow systems with discharging well storage readily feasible. It was found that as pumping time becomes very short relative to recovery time, the type recovery curves approach as a limit the curves of Cooper, et al for recovery after instantaneous drawdown. Recovery data from a test at Dawsonville, Georgia, were used as an example. (Lee-ISWS)
W77-09340

THE SPACIAL DISTRIBUTION OF GROUND-WATER DISCHARGE INTO THE LITTORAL ZONE OF A NEW ZEALAND LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
P. H. John, and M. A. Lock.
Journal of Hydrology, Vol. 33, No. 3/4, p 391-395, 1977. 1 fig, 1 tab, 6 ref.

Descriptors: *Groundwater movement, *Base flow, *Lakes, Spatial distribution, Sediments, Discharge(Water), Flow, Measurement, Foreign countries, On-site investigations, Water sources, Foreign research, Water supply.
Identifiers: *New Zealand, *Lake Rotorua(New Zealand), Littoral zones.

The spacial distribution of groundwater discharge into the littoral zone of Lake Rotorua (New Zealand) was determined by direct measurement. Discharges at two stations on the eastern shore were found to be 2.8 and 5.0 times greater than the discharge at any of the other five stations gauged. On transects at right angles to the shoreline, flow rate varied inversely with depth and distance from shore. The maximum discharge recorded was 127.5 liters per sq m per day, and the minimum was 2.7 liters per sq m per day. It was concluded that the technique employed could be an extremely useful tool when investigating groundwater discharge into lakes. (Sims-ISWS)
W77-09341

FINITE-ELEMENT ANALYSIS OF GROUND-WATER FLOW IN MULTI-AQUIFER SYSTEMS, II. A QUASI THREE-DIMENSIONAL FLOW MODEL,
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
K. Fujinawa.
Journal of Hydrology, Vol. 33, No. 3/4, p 349-362, 1977. 7 fig, 1 tab, 13 ref.

Descriptors: *Finite element analysis, *Groundwater movement, *Aquifer systems, *Numerical analysis, Mathematical models, Equations, Computer models, Theoretical analysis, Leakage, Aquitards, Aquifer characteristics, Transmissivity, Storage coefficient, Theis equation, Artesian heads.
Identifiers: *Multiple-aquifer systems, Three-dimensional flow, Galerkin method, Analytical solutions.

An integrated model with a one-dimensional finite-element analysis for solving the vertical flow equations in aquitards and a two-dimensional finite-element analysis for solving the horizontal flow equations in aquifers was developed to analyze quasi three-dimensional groundwater flow. The numerical results were compared to the analytical solution obtained by Neuman and Witherspoon. Ex-

cept at small values of the dimensionless time, good agreement with the analytical solution was obtained. The advantage of the method lies in the simplification of the calculation procedure and in the reduction of computing time and storage. (See also W77-07148) (Visocky-ISWS)
W77-09362

THE RELEASE OF METAL IONS TO GROUND WATER BY SOILS,
Tuskegee Inst., Ala. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 5B.
W77-09405

MULTIPHASE FLUID FLOW THROUGH POROUS MEDIA,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W77-09408

2G. Water In Soils

PERSISTENCE OF PROPANIL, DCA, AND TCAB IN SOIL AND WATER UNDER FLOODED RICE CULTURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 5B.
W77-09128

THE CHEMICAL COMPOSITION OF THE LYSIMETRIC WATER FROM SANDY PODZOLIC SOIL AND CHANGES AFFECTED BY FERTILIZERS, (IN RUSSIAN),
Leningrad State Univ. (USSR).
For primary bibliographic entry see Field 2K.
W77-09277

INFLUENCE OF CROP MANAGEMENT PRACTICES ON NUTRIENT MOVEMENT BELOW THE ROOT ZONE IN NEBRASKA SOILS,
Nebraska Univ., Lincoln. Agricultural Experiment Station.
J. Muir, J. S. Boyce, E. C. Seim, P. N. Mosher, and E. J. Deibert.
Journal of Environmental Quality, Vol. 5, No. 3, p 255-259, July-September 1976. 9 fig, 12 ref.

Descriptors: *Nitrogen, *Potassium, *Root zone, *Leaching, Irrigation effects, *Nebraska, Soil investigations, Alfalfa, Corn, Nutrients, Path of pollutants.

Deep profile sampling under different water and crop management systems revealed limited movement of N and none of P from the rooting profile of nonirrigated Nebraska soils. Leaching of N to the water table was apparent in most irrigated soils located on valley positions and in sandy soils of the uplands. Alfalfa with its deep rooting system was an effective scavenger of inorganic N that may have accumulated under crops. (Skogerboe-Colorado State)
W77-09279

EFFECT OF PH AND COMPLEX FORMATION ON MERCURY (II) ADSORPTION BY BENTONITE,
Kansas State Univ., Manhattan. Dept. of Agronomy.
D. W. Newton, R. Ellis, Jr., and G. M. Paulsen.
Journal of Environmental Quality, Vol. 5, No. 3, p 251-254, July-September 1976. 3 fig, 3 tab, 14 ref.

Descriptors: *Heavy metals, *Clays, *Chlorides, *Salts, *Mercury, Aquatic environment, Aquatic population, Adsorption, Bentonite, Soil analysis.
Identifiers: *Desorption, *Aquatic ecosystems.

Reactions of Hg with bentonite clay were studied to determine behavior of the metal in aquatic ecosystems. Mercury (II) adsorption by bentonite as a function of pH and complex formation was investigated using a radioisotopic technique. Maximum Hg (II) adsorption in 0.01M Ca (NO₃)₂ systems occurred in the pH range 4.5-5.5. Varying the Ca(NO₃)₂ concentration only slightly influenced adsorption or the pH of maximum adsorption. Chloride ions sharply reduced Hg(II) adsorption, especially at low pH's. At pH 6 or lower, increasing CaCl₂ concentration from 0.00001 to 0.0001M depressed adsorption; higher CaCl₂ levels were required to decrease adsorption at pH 7. At a given Cl(-) concentration, maximum observed Hg(II) adsorption occurred near the calculated pH where HgClOH occurred as a transition complex between HgCl₂ and Hg(OH)₂. Chloride salts were more effective desorbers of Hg(II) than was 0.01M Ca(NO₃)₂ or various 0.01N acids. HCL (0.01N) removed the most adsorbed Hg(II). (Skogerboe-Colorado State)
W77-09281

BEHAVIOR OF CHROMIUM IN SOILS: II. HEXAVALENT FORMS,
Vermont Univ., Burlington. Dept. of Plant and Soil Science.
R. J. Bartlett, and J. M. Kimble.
Journal of Environmental Quality, Vol. 5, No. 4, p 383-386, October-December 1976. 2 fig, 4 tab, 7 ref.

Descriptors: *Chromium, *Adsorption, Organic matter, Soils, Soil investigations, Farm wastes, Aluminum, Phosphorus, Pollutant identification, Soil analysis, Soil chemistry.

Adsorption and reduction of added Cr(VI) were characterized in soils with contrasting pH's organic matter contents, and chemical and mineralogical properties. Presence of soil organic matter brought about spontaneous reduction of Cr(VI) to Cr(III), even at pH's above neutrality. Reduction did not occur in soils very low in organic matter unless an energy source was added. Cow manure added to practically organic-free Cecil B2 reduced Cr(IV) only after the pH had been lowered below 3 with HCl. The solubility of Cr(VI) in the presences of excess Al changed in a pattern reminiscent of orthophosphate. All of the soils, except of pH 7.8 Cea horizon material, adsorbed Cr(VI). Presence of orthophosphate prevented the adsorption of Cr(VI), presumably by competition for the adsorption sites. Consistent with this finding, KH₂P0₄ was found to be the best extracting agent for Cr(VI) is quickly reduced by soil organic matter. Thus, Cr(VI) added to a soil will remain mobile only if its concentration exceeds both the adsorbing and the reducing capacities of the soil. (Skogerboe-Colorado State)
W77-09283

NITROGEN BALANCE IN THE SOUTHERN SAN JOAQUIN VALLEY,
California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 5B.
W77-09284

EFFECT OF MICROORGANISMS ON THE SORPTION AND FATE OF SULFUR DIOXIDE AND NITROGEN DIOXIDE IN SOIL,
Cornell Univ. Agricultural Experiment Station, Ithaca, N.Y. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-09285

EFFECT OF DISSOLVED OXYGEN ON REDOX POTENTIAL AND NITRATE REMOVAL IN FLOODED SWAMP,
Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
For primary bibliographic entry see Field 5C.
W77-09286

Field 2—WATER CYCLE

Group 2G—Water In Soils

SPLASH EROSION OF PRIMARY PARTICLES AND AGGREGATES

Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Soils. For primary bibliographic entry see Field 2J. W77-09288

THE EFFECT OF TEMPERATURE AND SOIL WATER ON CONVERSION OF DDT TO DDE IN SOIL

Agricultural Research Service, Fort Collins, Colo. For primary bibliographic entry see Field 5B. W77-09289

POTASSIUM STATUS OF SOME ALLUVIAL SOILS IN KENTUCKY

Kentucky Univ., Lexington. Dept. of Agronomy. M. Rasnake, and G. W. Thomas. Soil Science Society of America Journal, Vol. 40, No. 6, p 883-886, November-December 1976. 7 fig, 3 tab, 21 ref.

Descriptors: *Kentucky, *Potassium, *Bermudagrass, Soil chemistry, Soil chemical properties, Soils, Soil investigations, Pollutant identification.

Six alluvial soils from Kentucky were intensively cropped to 'Midland' bermudagrass to determine K availability in each soil. Potassium removal by the bermudagrass was compared to exchangeable K, to labile K estimated from Beckett quantity/intensity plots and to Gapon coefficients before and after cropping. Exchangeable K was not a good measure of uptake ($r = 0.61$ not significant), but labile K determined on soils before cropping and the Gapon coefficient after cropping gave highly significant linear correlations with K removed by bermudagrass. Exchangeable K after cropping changed an average of only 23 ppm K in the soils, but availability of K to plants was lowered drastically in all soils. This study shows that exchangeable K is an insensitive measurement of K availability to plants. Exchangeable K is a useable measurement only because wide ranges are used in determining classes of availability in soil testing. (Skogerboe-Colorado State) W77-09290

CALCIUM RETENTION IN RESPONSE TO PHOSPHATE SORPTION BY SOILS

Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science. J. C. Ryden, and J. K. Syers. Soil Science Society of America Journal, Vol. 40, No. 6, p 845-846, November-December 1976. 1 tab, 8 ref.

Descriptors: *Sorption, Desorption, Precipitation (Atmospheric), Calcium, Potassium, Soil chemistry, Soil investigations. Identifiers: *Calcium retention (Soils), *Phosphate sorption (Soils).

Retention of Ca increased in response to P sorption by soils, but was independent of the amounts of added Ca. Rather constant values were obtained for the molar ratio of Ca/P retained (0.19 to 0.34). Retained Ca was essentially recovered in 1M KCl washings in contrast to the fractional recovery of sorbed P. The retention of Ca in response to P sorption by soils is interpreted as arising from a sorption rather than a precipitation reaction, and results from the increase in negative charge induced by P sorption. (Skogerboe-Colorado State) W77-09291

CORRECTION OF 'TUBE CONTRIBUTION' INTERFERENCE IN THE DETERMINATION OF HEAVY METALS BY X-RAY SPECTROSCOPY USING THE 'ADDITIONS TECHNIQUE'

Maryland Agricultural Experiment Station, College Park. Dept. of Soil Science. For primary bibliographic entry see Field 5A. W77-09292

SOIL AIR PRESSURE EFFECTS ON ROUTE AND RATE OF INFILTRATION

Agricultural Research Service, St. Paul, Minn. D. R. Linden, and R. M. Dixon. Soil Science Society of America Journal, Vol. 40, No. 6, p 963-965, November-December 1976. 3 fig, 7 ref.

Descriptors: *Infiltration, *Soil water, *Soil moisture, Soil properties, Soil investigations, Soils. Identifiers: *Soil air pressure.

One centimeter of 0.1% methylene blue solution was infiltrated into soil with various constant soil air pressures beneath the wetting surface to measure flow into and through soil macropores. Flow was increasingly impeded as soil air pressure increased from 0 to 5 mbars. Infiltration rates during the first 3 min of wetting were decreased by an order of magnitude with 5 mbars of air-back pressure. (Skogerboe-Colorado State) W77-09293

A SEMIAUTOMATED PROCEDURE FOR TOTAL NITROGEN IN PLANT AND SOIL SAMPLES

Florida Univ., Gainesville. Dept. of Agronomy. For primary bibliographic entry see Field 2K. W77-09294

AN IMPROVED TECHNIQUE FOR MEASURING SOIL PH

Montana Agricultural Experiment Station, Bozeman. A. Mubarak, and R. A. Olsen. Soil Science Society of America Journal, Vol. 40, No. 6, p 880-882, November-December 1976. 2 fig, 3 tab, 17 ref.

Descriptors: *Soil properties, Soil investigations, Soil chemistry, Soil chemical properties, Laboratory tests, *Hydrogen ion concentration, *Analytical techniques, Measurement, *Soil analysis. Identifiers: Immiscible displacement, *Soil pH.

Soil solution is obtained by immiscible displacement using centrifugation in the presence of an excess of carbon tetrachloride. A combination glass electrode is then introduced into the soil solution which is floating on top of the carbon tetrachloride. By keeping the system closed, changes in pH induced by loss or gain of carbon dioxide are avoided. No water need be added to a naturally occurring soil so changes in pH induced by the dilution effect and/or the salt effect are obviated. There is no contact between reference electrode and soil particles so there is considered to be no junction error involved in the measurement. The technique is simple and reasonably convenient; the readings are stable and apparently reliable. (Skogerboe-Colorado State) W77-09295

USE OF UNDISTURBED CORES OF SURFACE SOIL FOR INVESTIGATING LEACHING LOSSES OF SULPHUR AND PHOSPHORUS

Victoria Dept. of Agriculture, Melbourne (Australia). Div. of Agricultural Chemistry. K. I. Peverill, and L. A. Douglas. Geoderma, Vol. 16, p 193-199, October, 1976, 3 fig, 2 tab, 18 ref.

Descriptors: *Cores, *Core drilling, *Leaching, *Soil surfaces, *Sulfur, *Phosphorus, Sands, Fertilizers, Nutrients, Sampling, Drilling samples, Percolation, Topsoil, Water pollution sources.

Leaching of applied phosphorus and sulfur from soil has been extensively studied in the field. In the laboratory, many leaching studies have been undertaken but have involved the use of packed soil columns. In this study undisturbed soil cores ten centimeters long were collected using a precisely

constructed 8.5 centimeter diameter soil sampler. To study the loss of sulphur and phosphorus from these cores due to leaching, a technique was developed for encasing the walls of the cores in a micro-crystalline wax. Distilled water was applied to the surface of the cores and sulphur and phosphorus loss determined. Results show that the use of undisturbed soil cores should not lead to exaggerated losses of sulphur and phosphorus from the soil as occurs when packed soil columns are employed, and a constant rate of percolation through the soil can be maintained, thus preventing the occurrence of conditions associated with water-logging. (Jamail-Arizona) W77-09309

COMMENTS ON THE MECHANISM OF SOIL DETACHMENT BY RAINFALL

Hebrew Univ., Jerusalem (Israel). Dept. of Geology. S. Yariv. Geoderma, Vol. 15, p 393-400, June, 1976, 15 ref.

Descriptors: *Soil mechanics, *Rainfall, *Soil erosion, *Soil water movement, *Soil moisture, Rain, Precipitation (Atmospheric), Soil density, Particle size, Soil water, Moisture, Soil physics, Rainfall-runoff-relationships, Rainfall intensity, Precipitation intensity, Erosion, Moisture content, Hydration, Mathematical models, *Impact (Rainfall).

The effect of rain in detaching and dislodging some of the soil particles upon which it falls is well known. However, not all particle sizes are equally susceptible to detachment. Because of their physical mass, gravel and very coarse sand may be very resistant to detachment. Coarse and medium size particles detach quite readily under raindrop impact. From the coarse sand sizes through silt sizes, resistance to detachment decreases. The object of this study is to propose an alternative to explanations already offered for the decrease in the relative detachability of small soil particles. This explanation is based on the fact that most minerals in the small size fraction have high hydration energies. The model used to describe the mechanism of detachment deals with three extreme stages: (1) dry soil; (2) soil water mixture (fluid soil), and (3) soil and overland flow. It is shown that in all three stages the decrease in relative detachability is governed in part by the two factors of particle size and hydration. A mathematical model is presented to describe the probability of detachment of soil particles during all three stages. (Jamail-Arizona) W77-09313

SATELLITE MICROWAVE OBSERVATIONS OF SOIL MOISTURE VARIATIONS

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center. T. J. Schmugge, J. M. Meneely, A. Rango, and R. Neff. Water Resources Bulletin, Vol. 13, No. 2, p 265-281, April 1977. 11 fig, 1 tab, 7 ref.

Descriptors: *Remote sensing, *Soil moisture, *Central U.S., Soils, Vegetation, Vegetation effects, Satellites (Artificial), Aircraft, Microwaves, Rainfall, Antecedent precipitation, Precipitation (Atmospheric), Soil water, Crops, Soil moisture meters, Measurement, Monitoring, Water resources, Agriculture. Identifiers: *Microwave radiometers.

Results from studies in the Illinois-Indiana and Texas-Oklahoma areas indicated that satellite microwave observations at the 1.55 cm wavelength are responsive to relative moisture variations in the near surface layer of the soil. Because significant vegetation cover absorbs the 1.55 cm microwave emission from the soil, the target area must be predominately bare soil or low density vegetation cover for meaningful measurements to result. The 25 km resolution of the satellite sensor limits application of the microwave techniques to

large areas such as watersheds or agricultural districts rather than individual fields. In general, at 1.55 cm, there is an inverse relationship between microwave brightness temperature and changes in soil moisture levels (as indicated by antecedent rainfall) in agricultural regions before planting of crops or during the early growing season when vegetation cover is sparse. Even early season observations should be of great value in deciding on the time and type of crop planting and for initial irrigation scheduling when the root zone is still in close proximity to the surface. (Sims-ISWS)
W77-09335

HYDROLOGY OF TWO SMALL WETLAND BASINS IN EASTERN MASSACHUSETTS,
Lowell Univ., Mass. Dept. of Earth Sciences.
For primary bibliographic entry see Field 2A.
W77-09336

SCALING FIELD-MEASURED SOIL HYDRAULIC PROPERTIES USING A SIMILAR MEDIA CONCEPT,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
A. W. Warrick, G. J. Mullen, and D. R. Nielsen.
Water Resources Research, Vol. 13, No. 2, p 355-362, April 1977. 2 fig, 1 tab, 12 ref.

Descriptors: *Hydraulic properties, *Soils, *Scaling, Soil water movement, *Hydraulic conductivity, Unsaturated flow, Hydrology, Soil physics, Flow, On-site investigations, *Soil physical properties.
Identifiers: Unsaturated hydraulic conductivity, Similar media concept.

Field data for soil water characteristic relationships and unsaturated hydraulic conductivity were scaled by using the concept of similar media in order to study water flow in spatially varying soils. Data observed by different investigators at three geographic areas were used. The soil water characteristic data consisted of 840, 900, and 512 observations, while data for the unsaturated hydraulic conductivity (available from only one of the three sources) consisted of 2,640 observations. In the process of scaling the data, a best fit for the scaled data was defined in terms of a sum of squares about an 'average' curve, using one value for the scaling parameter for each sampling location. Comparisons made between curves fitting the data and curves fitting the scaled data showed that scaling reduces the sums of squares by amounts varying from 34 to over 90%. For similar media, the scaling parameter determined at a given sampling location for the soil water characteristic relationship (a sub r from $h(S)$) should be identical to the scaling parameter for the unsaturated hydraulic conductivity (a sub r from $K(S)$). Although the parameters were highly correlated ($r = 0.91$) for the only set of data available, a sub r from $h(S)$ values were shown to be more effective in scaling the unsaturated hydraulic conductivity data than were a sub r from $K(S)$ values in scaling soil water characteristic data. (Roberts-ISWS)
W77-09350

VERTICAL INFILTRATION IN DRY SOIL,
Cornell Univ., Ithaca, N.Y. School of Civil and Environmental Engineering.
W. Brutsaert.
Water Resources Research, Vol. 13, No. 2, p 363-368, April 1977. 26 ref.

Descriptors: *Infiltration, *Soils, *Vertical migration, Dry beds, Sorption, *Infiltration rates, Soil water movement, Capillary conductivity, Equations, Mathematical studies.
Identifiers: *Vertical infiltration, Differential equations, Water content profile, Quasi-steady-state method, Soil water diffusivity, Infiltration equation.

An approximate method was proposed to integrate the ordinary differential equations governing the terms in Philip's series formulation of the water content profile. The method is related to the weighing solution used earlier for the sorption problem, and it is intermediate between the quasi-steady state method and the sharp front method. In a comparison with an available exact solution, it was shown that the derived solution is usually accurate to within less 1%. The water content profile and the infiltration rate can be expressed concisely in terms of soil physical parameters by making use of suitable expressions for the soil water diffusivity and for the capillary conductivity. As an illustration, the infiltration rate was calculated for the Averjanov-Irmay capillary conductivity and for the author's three-parameter power function diffusivity. Inspection of two extreme cases in the calculation finally lead to a new infiltration equation in closed form which is valid for short and for large times of infiltration. (Roberts-ISWS)
W77-09351

THE RELEASE OF METAL IONS TO GROUND WATER BY SOILS,
Tuskegee Inst., Ala. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 5B.
W77-09405

MULTIPHASE FLUID FLOW THROUGH POROUS MEDIA,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. A. Wooding, and H. J. Morel-Seytoux.
Annual Review of Fluid Mechanics, Vol 8, 1976, p 233-274. 15 fig, 196 ref. OWRD B-144-COLO(2). 14-34-0001-6064.

Descriptors: *Porous media, *Flow, *Reviews, *Bibliographies, Fluid mechanics, *Infiltration, Model studies, *Flow characteristics, *Capillary action, Capillary water.
Identifiers: *Multiphase fluid flow, Two-phase flow.

Research is reviewed on isothermal flow of immiscible phases in rigid porous media, with emphasis on two-phase flow. Particular attention is given to mechanisms of immiscible displacement, and theories of wetting of solids which relate to the motion of solid-liquid-fluid contact lines in displacement flows. Flow in packed towers is reviewed from the macroscopic aspect, and simple kinematic-wave models are observed to be useful for high Reynolds number flows, including the prediction of 'flooding'. Green-Ampt theory is still considered a successful macroscopic model of capillary uptake by, or infiltration into, porous media; later theories of infiltration are also reviewed. Capillary hysteresis during cycles of wetting and drying is still difficult to incorporate into hydrologic infiltration models. Infiltration can be better treated as a two-phase problem, using Buckley-Leverett theory, with capillarity specially treated at moisture 'fronts'. In some cases, however, such fronts are macroscopically unstable and fingering may occur. Multiphase flow under cold conditions, with possible ice formation and soil heaving, is also reviewed briefly.
W77-09408

NITRATE-NITROGEN MOVEMENT THROUGH SOIL AS AFFECTED BY SOIL PROFILE CHARACTERISTICS,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
For primary bibliographic entry see Field 5B.
W77-09427

NITRATE LEAKAGE FROM SOILS DIFFERING IN TEXTURE AND NITROGEN LOAD,
Technion - Israel Inst. of Tech., Haifa. Lab. of Soil Science.
Y. Avnimelech, and J. Raveh.

Journal of Environmental Quality, Vol. 5, No. 1, p 79-82, January-March 1976. 1 fig, 1 tab, 10 ref.

Descriptors: *Nitrogen, *Nitrates, *Chlorides, Soil profiles, *Soil texture, Clay soils, Leaching, Denitrification, Soil investigations, Soils, Distribution, Path of pollutants.
Identifiers: *Nitrogen load(Soils).

Nitrogen and chloride distribution in soil profiles underlying plots differing in the nitrogen load and soil type were studied in the coastal plain of Israel. Nitrate leakage was defined as the product of the average nitrate concentration in subsoil solution times the annual water recharge. A large portion of the excessive nitrogen (nitrogen load minus nitrogen uptake by the removal crop) was not recovered. This portion is high for clay soils and for plots receiving high nitrogen dressings. Changes in the NO_3/Cl ratio along the soil profile coincided with nitrate removal. The data support the hypothesis that nitrate removal is mainly due to denitrification in the top layer of the soil. (Skogerboe-Colorado State)
W77-09428

SOIL NITRATES FOLLOWING FOUR YEARS CONTINUOUS CORN AND AS SURVEYED IN IRRIGATED FARM FIELDS OF CENTRAL AND EASTERN COLORADO,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-09429

USE OF THE GREEN-AMPT EQUATION WITH VARIABLE CONDUCTIVITY,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
L. R. Ahuja, and G. Y. Tsuji.
Soil Science Society of America Journal, Vol. 40, No. 4, p 619-622, July-August 1976. 2 fig, 13 ref.

Descriptors: *Infiltration, *Hydraulic conductivity, Soil water, *Soil water movement, *Hawaii, Equations.
Identifiers: *Green-Ampt equation, Sorptivity.

A comparison with Philip's two-term equation, derived from a series solution involving $t^{1/2}$, indicates that the hydraulic conductivity in the Green-Ampt equation of vertical infiltration varies with time when the soil water content of the transmission zone is assumed to be constant. Use of the Green-Ampt equation with a continuously variable conductivity or a piecewise application of the equation as an extension of Philip's two-term equation resulted in improved prediction of infiltration in two Hawaii soils. Both these forms of application require three parameters, hydraulic conductivity, sorptivity, and constant A , which well-established physical meaning. (Skogerboe-Colorado State)
W77-09430

BEHAVIOR OF CHROMIUM IN SOILS: I. TRIVALENT FORMS,
Vermont Univ., Burlington. Dept. of Plant and Soil Science.
R. J. Bartlett, and J. M. Kimble.
Journal of Environmental Quality, Vol. 5, No. 4, p 379-383, October-December 1976. 2 fig, 4 tab, 9 ref.

Descriptors: *Aluminum, *Chromium, Field capacity, Soils, Soil investigations, Adsorption, Phosphorus, Chemical reactions, Soil chemistry.
Identifiers: Sodium pyrophosphate.

Chemical behavior of Cr(III) was studied in solutions, soil suspensions, and in soils of contrasting characteristics incubated at field capacity moisture. Sodium pyrophosphate, pH 4.8 NH_4OAc , and 0.1 M NaF appeared to extract organically bound Cr(III), whereas 1M HCl removed

Field 2—WATER CYCLE

Group 2G—Water In Soils

inorganic Cr hydroxides and phosphates along with some organic Cr. Pyrophosphate and HCl extracts represented quantities of Cr(III) removed; NH₄Ac and NaF extracts appeared to characterize small readily removed fractions, that is, intensity factors. Soil organic complexes of Cr(III) formed at low pH and appeared to remain stable and soluble even when soil pH's were raised to levels where the Cr would be expected to precipitate. Adsorption and solubility behavior of Cr(III) as it varied with pH and P treatments was similar to that of Al. Oxidation of Cr(III) to Cr(VI) was not demonstrated at all, even under conditions of maximum aeration and high pH. (Skogerboe-Colorado State)
W77-09432

COMPARISON OF FIELD-MEASURED AND CALCULATED SOIL-HEAT FLUXES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
B. A. Kimball, R. D. Jackson, F. S. Reginato, F. S. Nakayama, and S. B. Idso.
Soil Science Society of America Journal, Vol. 40, No. 1, p 18-25, January-February 1976. 5 fig, 1 tab, 32 ref.

Descriptors: *Soil temperature, *Thermal conductivity, *Heat flow, Soils, Soil investigations, Water vapor, Temperature, Soil water movement.
Identifiers: Soil-heat fluxes.

Soil-heat fluxes calculated using DeVries' theory (1958,1963) were compared with those experimentally determined in a field of Avondale loam at Phoenix, Arizona, on 6 days representing different seasons of the year. A fair agreement between measured and computed fluxes as obtained only after modifying the air shape factor curve and ignoring heat transfer due to water vapor movement. The omission of the latter implied that heat transfer by pure conduction was most important and that thermal and isothermal vapor fluxes exactly cancelled during the day and were insignificant at night. 'Measured' thermal conductivities were also determined from the ratio of the measured heat fluxes to the corresponding temperature gradient for those times when it was unlikely that isothermal vapor movement was significant. The lack of a temperature dependence in these data, as well as the flux comparisons, strongly indicate that the theory over estimated thermal vapor movement. These data plus others in the literature indicate that an individual 'calibration' of the theory for a particular soil is required before reliable predictions of soil-heat flux can be obtained. (Skogerboe-Colorado State)
W77-09433

SOIL-HEAT FLUX DETERMINATION: TEMPERATURE GRADIENT METHOD WITH COMPUTED THERMAL CONDUCTIVITIES,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
B. A. Kimball, R. D. Jackson, F. S. Nakayama, S. B. Idso, and R. J. Reginato.
Soil Science Society of America Journal, Vol. 40, No. 1, p 25-28, January-February 1976. 1 fig, 2 tab, 13 ref.

Descriptors: *Thermal conductivity, *Heat flow, Soils, Soil investigations, Soil properties, Methodology.
Identifiers: Temperature gradient, Calorimetry, *Soil-heat fluxes.

Surface soil-heat fluxes were determined for 6 days in a field of Avondale loam using the null-alignment method, the combination method, and four variations of the temperature gradient method with thermal conductivities computed from the DeVries' theory for particular reference depths. For all methods, calorimetry was used to obtain the surface flux from the flux determined for the reference depth. There was 10% or less difference between the null-alignment, combination, and

temperature gradient methods for a 20-cm reference depth. However, the difference with respect to the null-alignment method increased to 35% for a 5-cm reference depth when DeVries' theory was closely followed. This difference was reduced to 3% when a modified air shape factor was used in the computations and all vapor movement was ignored. The temperature gradient method with conductivities computed from DeVries' theory can be reliably used with a 20-cm reference depth, but a 'calibration' of the theory for a particular soil should be obtained before the method is used with a 5-cm reference depth. (Skogerboe-Colorado State)
W77-09434

THE INFLUENCE OF APPLIED PHOSPHORUS, MANURE, OR LIME ON UPTAKE OF LEAD FROM SOIL,
Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
For primary bibliographic entry see Field 5B.
W77-09435

A METHOD FOR SECTIONING SATURATED SOIL CORES,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
K. R. Reddy, and W. H. Patrick, Jr.
Soil Science Society of America Journal, Vol. 40, No. 4, p 611-614, July-August 1976. 3 fig, 2 tab, 5 ref.

Descriptors: *Laboratory tests, *Sampling, Soils, Soil physical properties, Soil investigations, Ions, *Cores, *Methodology.

A simple system for sectioning water-saturated cores without prior freezing is described. The method described can be used for studying the distribution and movement of ions in soil or sediment cores prepared in the laboratory or obtained in undisturbed form from the field. The average coefficient of variation was 4.8% for the sectioning of the cores prepared in the laboratory and 10.5% for the sectioning of the cores obtained from the field. (Skogerboe-Colorado State)
W77-09436

NITRIFICATION-DENITRIFICATION REACTIONS IN FLOODED SOILS AND WATER BOTTOMS: DEPENDENCE ON OXYGEN SUPPLY AND AMMONIUM DIFFUSION,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
W. H. Patrick, Jr., and K. R. Reddy.
Journal of Environmental Quality, Vol 5, No 4, p 469-472, October-December 1976. 5 fig, 10 ref.

Descriptors: *Nitrogen, *Denitrification, *Nitrification, *Oxygen, Anaerobic, Aerobic, Soils, Soil investigations, Nitrate, Ammonium, *Soil chemistry, Flooding.
Identifiers: *Ammonium diffusion, Submerged soils, Flooded soils.

Ammonium nitrogen in a flooded soil or water bottom exposed to oxygen from the water column undergoes sequential nitrification and denitrification. Oxygen moving through the overlying water column causes the development of an aerobic surface layer of soil or sediment. Ammonium in this aerobic surface layer is nitrified and the resulting ammonium concentration gradient across the aerobic layer and the underlying anaerobic layer causes ammonium in the anaerobic layer to diffuse upward into the aerobic layer where it also undergoes nitrification. Nitrate produced in the aerobic layer then diffuses downward into the anaerobic layer where it is denitrified to N₂ and N₂O. Nitrate derived from ammonium nitrogen in the aerobic layer appears as an intermediate product in the nitrification-denitrification reaction. A laboratory experiment utilizing N-15 as a tracer showed that approximately one-half of the

nitrogen involved in the nitrification-denitrification process was ammonium originally present in the surface aerobic soil or water bottom layer with the remainder diffusing up from the underlying anaerobic layer. Where oxygen was absent or limiting, nitrification either did not occur or occurred at a lower rate, resulting in a reduced amount of nitrate available for the denitrification process. (Skogerboe-Colorado State)
W77-09437

FATE OF FERTILIZER NITROGEN IN A FLOODED RICE SOIL,
Louisiana State Univ., Baton Rouge. Lab. of Flooded Soils and Sediments; and Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
W. H. Patrick, Jr., and K. R. Reddy.
Soil Science Society of America Journal, Vol 40, No 5, p 678-681, September-October 1976. 3 fig, 4 tab, 11 ref.

Descriptors: *Rice, *Fertilization, *Nitrogen, Nutrients, Soil investigations, Flood irrigation, Irrigation affects, Irrigation, Flooding, Fertilizers.
Identifiers: *Rice fertilization, Flooded soils.

In order to improve the efficiency of fertilizer N utilization by rice, it is important to know what happens to N applied to the soil. Field experiments utilizing N₁₅-enriched ammonium sulfate were carried out to determine the fate of fertilizer N (100 kg N/ha) applied to Crowley silt loam soil. The distribution of fertilizer N in the plant-soil system at harvest time was determined using 2.32 sq m plots. The distribution of fertilizer N in the plant-soil-floodwater system at six times during the growing season was measured in smaller plots (0.28 sq m). The results from the larger plots showed that fertilizer N recovered in the grain ranged from 30.9 to 37.3 kg N/ha depending on the method of application. Recovery of fertilizer N in the straw ranged from 18.2 to 24.2 kg N/ha. A considerable portion of fertilizer N (24.2 to 27.1 kg N/ha) remained in the soil (including roots) after cropping. Total recovery of the 100 kg/ha addition of labelled fertilizer N in the soil-plant system was 75.0 to 85.6 kg N/ha for the different methods of N application examined. Experiments using the smaller 0.28 sq m plots showed rapid uptake of fertilizer N immediately after application, with no apparent further uptake after about 3 weeks. Soil N was the major and perhaps sole source of N for the plant during the last part of the growing season. (Skogerboe-Colorado State)
W77-09438

ADSORPTION OF SELENITE AND PHOSPHATE ON AN ALLOPHANE CLAY,
Ruakura Agricultural Research Center, Hamilton (New Zealand). Soil Chemistry Group.
S. S. S. Rajan, and J. H. Watkinson.
Soil Science Society of America Journal, Vol 40, No 1, p 51-54, January-February 1976. 3 fig, 3 tab, 20 ref.

Descriptors: *Adsorption, *Clays, *Phosphates, Soils, Soil investigations, Soil properties, Soil chemistry, Anions, Anion adsorption, *Sulfates.
Identifiers: *Selenite, *Allophane clays.

Selenite was adsorbed on an allophane clay from solutions of different concentrations at pH 5.0, at 30C, and under a N₂ atmosphere, and the amounts of sulfate, silicate and hydroxyl ions released were measured. The results were compared with those from a similar study with phosphate on the same clay. The results indicate that at low concentrations both phosphate and selenite exchanged with adsorbed sulfate, adsorbed silicate, and aquo and hydroxo groups. About three times more phosphate than selenite was adsorbed, due mainly to phosphate displacing more aquo groups and thus making the surface less positive. At high concentrations, whereas the selenite adsorption reached a maximum, phosphate continued to be adsorbed. The latter was due to phosphate displac-

ing structural silicate and probably also to disruption of hydrous oxide polymers. A two-term Langmuir equation distinguished adsorption by surface ligand exchange from these other reactions at high concentration. (Skogerboe-Colorado State) W77-09439

HETEROVALENT CATION EXCHANGE EQUILIBRIA IN SOILS WITH VARIABLE AND HETEROGENEOUS CHARGE. California Univ., Davis. Dept. of Soil Science. D. N. Munns. Soil Science Society of America Journal, Vol 40, No 6, p 841-845, November-December 1976. 4 fig, 1 tab, 15 ref.

Descriptors: *Cation exchange, *Leaching, Soil properties, Soil investigations, *Calcium, *Magnesium, Lime, Ion exchange, *Potassium.

Divalent cations were incrementally displaced, from limed and un-limed samples of three soils, by suspending the soils in increasing volumes of 2mM KCl. Mass action coefficients for exchange between Ca and Mg were constant. But for the exchange of divalent cations by K, the exchange coefficients of Kerr, Vanselow, Gapon, Krishnamoorthy and Overstreet, and Gaines and Thomas increased markedly as potassium saturation or pH increased. For each cation species, separate fractions which were relatively loosely adsorbed could be estimated by a simple regression analysis. The loosely adsorbed Ca, which may control Ca availability to plants, could be independently estimated by a leaching procedure. Mass action exchange coefficients for the loosely adsorbed cations were approximately constant under all conditions tested. The variable charge mobilized by liming differed from the fixed charge in having a slightly higher proportion of sites with high divalent affinity, in an Oxisol, and a much lower proportion in a Vertisol and a Mollisol. (Skogerboe-Colorado State) W77-09440

IN SITU MEASUREMENT OF GAS DIFFUSION COEFFICIENT IN SOILS. Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences. S. H. Lai, J. M. Tiedje, and E. Erickson. Soil Science Society of America Journal, Vol 40, No 1, p 3-6, January-February 1976. 4 fig, 3 tab, 12 ref.

Descriptors: Soils, Soil investigations, Soil profiles, Gas chromatography, Soil properties, Carbon dioxide, *Gases, Diffusion, Oxygen. Identifiers: *In situ measurement, *Gas diffusion, Diffusion coefficient.

A method for determination of the gas diffusion coefficient of soils without disturbing the natural state of the soil was developed. The method was based on the theory of radial diffusion of a finite quantity of gas into a semi-infinite porous medium. Needles were inserted into the soil through which O_2 was injected. The change of concentration of the injected O_2 was determined by gas chromatography through the same needle after increasing periods of time. A least square fit between the measured O_2 concentrations and that of the theoretical values was conducted to find the best fit value of the diffusion coefficient. The diffusion coefficient determined by the proposed method was used to calculate the flux of CO_2 in field soils. The flux so calculated was compared to that measured from the field with good agreement. The method was used in several different field soils and conditions to determine the diffusion coefficients. (Skogerboe-Colorado State) W77-09442

PHOSPHORUS FERTILIZATION WITH DRIP IRRIGATION. California Univ., Davis. Dept. of Land, Air, and Water Resources.

For primary bibliographic entry see Field 3F. W77-09443

INFLUENCE OF PESTICIDES ON DENITRIFICATION IN SOIL AND WITH AN ISOLATED BACTERIUM. Pennsylvania State Univ., University Park. Dept. of Soil Microbiology. For primary bibliographic entry see Field 5B. W77-09445

METHYLATION OF MERCURY IN AGRICULTURAL SOILS. Environmental Protection Agency, Las Vegas, Nev. Office of Research and Development. R. D. Rogers. Journal of Environmental Quality, Vol 5, No 4, p 454-458, October-December 1976. 7 tab, 24 ref.

Descriptors: *Mercury, *Soil texture, *Soil moisture, Soil temperature, Soils, Soil investigations, Ions, Heavy metals, Water pollution. Identifiers: *Methylation, *Methylmercury, Mercuric nitrate, *Agricultural soils.

Methylation of applied divalent mercury ion was found to occur in agricultural soils. The production of methylmercury was affected by soil texture, soil moisture content, soil temperature, concentration of the ionic mercury amendment, and time. Methylation was directly proportional to clay content, moisture content, temperature, and mercury concentration. After an initial build-up of methylmercury in the soil, there appeared to be a mechanism that decreased the methylmercury content with increasing time. (Skogerboe-Colorado State) W77-09447

PHYSICAL AND HYDROPHYSICAL PROPERTIES OF THE SOILS AT THE GREENHOUSE UNIT ISALNITA-DOLJ, (IN RUMANIAN). Institutul de Studii si Cercetari Pedologie, Bucharest (Rumania). S. Balan, V. Sandu, G. Enache, and I. Naramzoiu. An Inst Stud Cercet Pedol. 40, p 73-88, 1972.

Descriptors: Soils, Greenhouses, *Soil physical properties, *Soil texture, Drainage, *Soil density, Soil profiles, Soil compaction, Permeability, Porosity. Identifiers: *Romania.

The soils are, generally of a fine texture in which the colloidal fraction prevails. The physical, mechanical and hydric properties of these soils are deficient in texture, permeability, total and aeration porosity, compaction, resistance to cultivation, etc. In the top and subsurface layers, the apparent densities are very high, generally above 1.50 to 1.70. The extremely high values of the apparent density are accounted for by soil subsidence and compaction resulting from seedbed preparation, management and, particularly, harvesting of greenhouse crops. In all profiles, the values of the total and aeration porosities are very low and unsatisfactory. The permeability of the same soils, assessed quantitatively by hydraulic conductivity, also show values that are very low (<10) or nil, varying according to soil texture and compaction. Due to their geomorphological position, and hydrogeological and hydrological status, as well as their deficiencies such as compaction and extremely low permeability, the soils of the area studied (Romania) need to be drained and meliorated as regards their physical and hydrophysical properties, by using sand, polystyrene, peat and other materials.—Copyright 1975, Biological Abstracts, Inc. W77-09448

CORN CULTIVATION IN THE SAND OF THE BUKHARA OASIS, (IN RUSSIAN). Bukharskii Gosudarstvennyi Pedagogicheskii Institut (USSR).

For primary bibliographic entry see Field 3F. W77-09446

FOREST SITE CONDITIONS OF BARCHANS UNDERLAIN BY TAKYRS, (IN RUSSIAN). Desert Inst., Ashkhabad (USSR). N. K. Lalyenko. Probl Osvoeniya Pustyn'. 6, p 42-50, 1973.

Descriptors: *Clays, Plant physiology, *Forests, *Classification, Distribution, Groundwater, *Sands, Soil horizons, Arid lands. Identifiers: *Barchans, Calligonum, Salsola-paletziana, Salsola-richter, *Takyr.

A broad classification of forest site conditions on small and medium barchans underlain by takyr (clay-surface deserts) is presented. The habitat of the plants, the thickness of the sand deposits, relief, particle-size distribution of the soils, characteristics of the structure of the lithologic profile, moisture factors (precipitation, takyr surface runoff, mudflows, etc.), depth of occurrence of moist soil horizons and groundwaters and characteristics of the root system of sand binders are included. Salsola richteri, Salsola paletziana and various Calligonum spp. are recommended for afforestation.—Copyright 1975, Biological Abstracts, Inc. W77-09497

CHARACTERISTICS OF THE MEANA-CHACHIN PLAIN SOIL-FORMING PROCESS, (IN RUSSIAN). Desert Inst., Ashkhabad (USSR). I. G. Tolstolykin, A. P. Lavrov, and E. V. Larin. Probl Osvoeniya Pustyn'. 3, p 21-28, 1974.

Descriptors: *Soil formation, Drainage, Saline soils, Soil types, Irrigation, Land reclamation. Identifiers: *USSR(Meana-Chachin plains), Takyo soils.

Takyr-like virgin and irrigated soils, takyr-like virgin and irrigated sierozems, typical takyr, residual and typical solonchaks are common for the territory of the Meana-Chaachinskaya plain (USSR). The soils have a heavy mechanical composition with large silty fraction, high rates of salinization and metabolic capacity. The major proportion of lands fit for reclamation are 30-35 m above the Karakum canal. Irrigation is accomplished by pumping. To prevent secondary soil salination, the erection of water collector-drainage network is necessary.—Copyright 1975, Biological Abstracts, Inc. W77-09502

ON THE PHYSICAL INTERPRETATION OF THE SOIL WATER DIFFUSIVITY IN TERMS OF THE THEORY OF MARKOV PROCESSES. Arizona Univ., Tucson. Dept. of Mathematics. R. Bhattacharya, V. Gupta, and G. Sposito. Soil Science, Vol. 121, No. 5, p 313-314 1976. OWRT B-046-ARIZ(2), 14-34-0001-6057.

Descriptors: *Markov processes, *Soil water movement, Diffusion, *Diffusivity. Identifiers: Standard Brownian motion.

In a recent paper, Laroussi and De Backer (See W76-01851) have given an interpretation of the soil water diffusivity in terms of the theory of Markov processes with space and time dependent coefficients. However, their analysis is based on a complete analogy with the theory of the standard Brownian motion process. This analogy is incorrect if the Markovian coefficients are space and time dependent. This fact is illustrated in detail for pointing out that the physical interpretation of soil water diffusivity given by Laroussi and DeBaker is invalid. (See also W76-04305) W77-09594

Field 2—WATER CYCLE

Group 2H—Lakes

2H. Lakes

HYDROGRAPHIC SURVEYING TURNS TO ELECTRONICS,
Tibbetts Abbett, McCarthy and Stratton, Seattle, Wash.
For primary bibliographic entry see Field 7B.
W77-09105

RECORDING RIVER AND RESERVOIR WATER DEPTH,
Moore, Gardner and Associates, Inc., Asheboro, N.C.
For primary bibliographic entry see Field 7B.
W77-09106

THE ENVIRONMENTAL IMPULSE AND ITS COMPETITORS: ATTITUDES, INTERESTS, AND INSTITUTIONS AT LAKE TAHOE,
California Univ., Davis. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W77-09145

A BACTERIAL WATER QUALITY INVESTIGATION OF CANYON LAKE, ARIZONA,
Arizona Univ., Tucson. Dept. of Watershed Management.
For primary bibliographic entry see Field 5C.
W77-09150

A REVIEW OF EPA'S GREAT LAKES MODELING PROGRAM,
Environmental Research Lab.-Duluth, Gross Ile, Mich. Large Lakes Research Station.
For primary bibliographic entry see Field 5B.
W77-09157

COMPARISON OF EUTROPHICATION MODELS,
Environmental Protection Agency, Atlanta, Ga. Technical Support Branch.
For primary bibliographic entry see Field 5C.
W77-09159

MATHEMATICAL MODEL OF A GREAT LAKES ESTUARY,
Environmental Protection Agency, Chicago, Ill.
For primary bibliographic entry see Field 5B.
W77-09166

RADIONUCLIDE TRANSPORT IN THE GREAT LAKES,
Office of Radiation Programs, Washington, D.C.
For primary bibliographic entry see Field 5B.
W77-09175

MODELING THE HYDRODYNAMIC EFFECTS OF LARGE MAN-MADE MODIFICATION TO LAKES,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W77-09177

AN EMPIRICAL MODEL FOR NUTRIENT RATES IN LAKE ONTARIO,
Environmental Protection Agency, Rochester, New York. Rochester Field Office.
For primary bibliographic entry see Field 5C.
W77-09178

EFFECTS OF IMPOUNDMENT ON WATER AND SEDIMENT IN THE ARKANSAS RIVER AT PUEBLO RESERVOIR,
University of Southern Colorado, Pueblo.
For primary bibliographic entry see Field 5B.
W77-09224

WETLANDS-RELATED LEGISLATION IN THE UNITED STATES,
Miami Univ., Fla. School of Law.
For primary bibliographic entry see Field 6E.
W77-09324

ESTIMATING THE SUSPENDED SEDIMENT LOAD IN RESERVOIRS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 2J.
W77-09331

ON THE FLUCTUATIONS IN LEVELS OF CLOSED LAKES,
Commonwealth Scientific and Industrial Research Organisation, D. J. Gates, and M. Diesendorf.
Journal of Hydrology, Vol. 33, No. 3/4, p 267-285, 1977. 1 fig, 11 ref, 1 append.

Descriptors: *Australia, *Lakes, *Stochastic processes, Lake basins, Model studies, Beaches, *Water levels, Climatic data, Runoff, Precipitation (Atmospheric), *Water level fluctuations.
Identifiers: *Closed Lakes, *Lake George, *New South Wales, Stochastic differential equation, Standard deviation, Late-quaternary climate, Beach formation, Runoff rate.

A stochastic differential equation model of closed lakes was introduced and analyzed, with particular reference to Lake George in New South Wales, Australia. Results indicated that the standard deviation in water level at the prehistoric 30-m level is approximately equal to the 1977 value at the 3-m level. At low water levels, the theory predicted that the expected level is slightly higher than that predicted by a purely deterministic theory. The model provided a more fundamental and complementary approach to the fluctuation calculations of Langbein. Also, the model provided some support for the work of Galloway, predicting a dry late-Quaternary climate, although the question of beach formation remained unresolved. (Roberts-ISWS)
W77-09338

THE SPACIAL DISTRIBUTION OF GROUND-WATER DISCHARGE INTO THE LITTORAL ZONE OF A NEW ZEALAND LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 2F.
W77-09341

A BIOLOGICAL AND CHEMICAL COMPARISON OF VARIOUS AREAS OF A RESERVOIR,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5C.
W77-09342

USE OF LARGE SUBMERGED CHAMBERS TO MEASURE SEDIMENT-WATER INTERACTIONS,
Great Lakes Basin Commission, Ann Arbor, Mich.
For primary bibliographic entry see Field 5B.
W77-09343

OXYGEN CONSUMPTION BY FRESHWATER SEDIMENTS,
Clemson Univ., S.C. Dept. of Environmental Systems Engineering; and Clemson Univ., S.C. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-09348

PRECIPITATION LOADING OF ACID AND HEAVY METALS TO A SMALL ACID LAKE NEAR SUDBURY (ONTARIO),
Fisheries and Marine Service, Nanaimo (British Columbia). Biological Station.
For primary bibliographic entry see Field 5A.
W77-09353

LACUSTRINE SEDIMENTS IN THE ALLEGHENY PLATEAU OF ERIE COUNTY, NEW YORK: THEIR CHARACTERISTICS, DISTRIBUTION, AND LAND USE PROBLEMS,
Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.
For primary bibliographic entry see Field 2J.
W77-09357

ENVIRONMENTAL CHANGES IN LAKE ERIE AND THEIR FUTURE IMPACT ON LAKE RESOURCES,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-09454

ECOLOGICAL STUDIES ON ALGAL-LYSING BACTERIA IN FRESH WATERS,
Dundee Univ. (Scotland). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-09469

ON THE OCCURRENCE OF THE SPECIES OF SYNURA (CHRYSOPHYCEAE),
For primary bibliographic entry see Field 5C.
W77-09476

MINERALOGICAL COMPOSITION OF SUBMERGED AQUATIC MACROPHYTES FROM CONNECTICUT,
For primary bibliographic entry see Field 5A.
W77-09477

MICROSTRATIFICATION OF LAKE WASHINGTON SEDIMENTS,
For primary bibliographic entry see Field 5C.
W77-09483

DISTRIBUTION AND SEASONAL VARIATION OF BENTHIC FAUNA IN LAKE MANITOBA,
For primary bibliographic entry see Field 5C.
W77-09484

CARBON DIOXIDE EXCHANGE AND PRODUCTIVITY IN LAKE ERIE AND LAKE ONTARIO,
For primary bibliographic entry see Field 5C.
W77-09485

THE AQUATIC THERMAL CAPSULE,
Southern Illinois Univ. at Carbondale. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W77-09486

EFFECTS OF MAN-INDUCED AND NATURAL LOADING OF PHOSPHORUS AND NITROGEN ON THE LARGE SWEDISH LAKES,
For primary bibliographic entry see Field 5C.
W77-09487

ANALYSIS OF THE MACROFAUNA-COMMUNITY ON STRATIOTES VEGETATIONS,
For primary bibliographic entry see Field 5C.
W77-09489

PHYTOPLANKTON PERIODICITY IN A NEW RESERVOIR, LAKE ANNA, VIRGINIA, Virginia Polytechnic Inst. and State Univ., Blacksburg.
For primary bibliographic entry see Field 5C.
W77-09493

INTERACTIONS BETWEEN POPULATION DENSITY AND WATER QUALITY PARAMETERS DURING A DINOFLAGELLATE BLOOM, For primary bibliographic entry see Field 5C.
W77-09494

TOTAL AND HYPOLIMNETIC AERATION OF LAKES IN WISCONSIN, Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5G.
W77-09495

THE ECOLOGICAL BEHAVIOR OF PLUTONIUM AND AMERICIUM IN A FRESHWATER POND, Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.
For primary bibliographic entry see Field 5C.
W77-09501

PHYTOPLANKTON OF LAKE RUSALKA (POLAND), (IN POLISH), Adam Mickiewicz Univ., Poznan (Poland). Inst. of Systematic Geography and Plant Protection. E. Kotlinska.
Poznan Tow Przyj Nauk Wydz Mat-Przyr Pr Kom Biol 42, p 3-53, 1976.

Descriptors: *Artificial lakes, *Phytoplankton, *On-site investigations, *Diatoms, Biorhythms, Distribution patterns, Lakes, Systematics, Algae, Biological communities, *Chlorophyta, Cyanophyta.
Identifiers: *Lake Rusalka(Poland), *Poland, Seasonal changes.

The specific composition, quantitative conditions, changes in the yearly cycle and periodic appearances of planktonic algae in artificial Lake Rusalka in Poznan (Poland) are discussed. Samples were taken from June 1969-1970 from 3 positions on the surface with a plankton net. During the summer there is a public bath near the lake. In the summer pollution increases near the public bath. In 1969/70, 328 taxa were determined. The greatest number of taxa occurred in the diatoms (120) and Chlorophyceae (89). Cyanophyceae dominated communities of algae. Considerable differences in the qualitative and quantitative composition of phytoplankton in particular seasons of the year are demonstrated. The greatest abundance of forms was noted during the spring, less during the summer. The richest communities of phytoplankton with respect to qualitative and quantitative composition were observed at the inflow of the River Bogdanka into the lake, a less rich one near the public bath and the poorest at the outflow of the river from the lake. This was influenced mainly by water contamination and by algae from the river Bogdanka.—Copyright 1977, Biological Abstracts, Inc.
W77-09507

SEGMENTED POPULATION MODEL OF PRIMARY PRODUCTIVITY, NUS Corp., Pittsburgh, Pa. Ecological Science Div.
For primary bibliographic entry see Field 5C.
W77-09512

A SPECIES OF STYLOSCOLEX MICHAELSEN (OLIGOCHAETA, LUMBRICULIDAE) FOUND IN TWO LAKES IN NORTHERN ALASKA, Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
For primary bibliographic entry see Field 5C.

W77-09513

PHYTOPLANKTON OF LAKE MALTA (POLAND) (IN POLISH), Adam Mickiewicz Univ., Poznan (Poland). Institute of Systematic Geography and Plant Protection.
For primary bibliographic entry see Field 5C.
W77-09515

LAKE DRAWDOWN AS A METHOD OF IMPROVING WATER QUALITY, Florida Univ., Gainesville.
For primary bibliographic entry see Field 5G.
W77-09516

ON ALEXANDROVIA ONEGENSIS HRAVE FROM ALASKA, WITH A REVISION OF THE TELMATODRILINAE (OLIGOCHAETA, TUBIFICIDAE), Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
For primary bibliographic entry see Field 5C.
W77-09518

THERMAL CONDUCTIVITY OF ORGANIC SEDIMENTS FROM TWO WISCONSIN LAKES, Cold Regions Research and Engineering Lab., Hanover, N.H. Earth Sciences Branch.
For primary bibliographic entry see Field 2J.
W77-09521

THE SEDIMENTS OF LAKE GEORGE (UGANDA). II: RELEASE OF AMMONIA AND PHOSPHATE FROM AN UNDISTURBED MUD SURFACE, Malaya Univ., Kuala Lumpur (Malaysia). School of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-09523

OCCURRENCE OF OSCILLATORIA AGARDHII GOM. IN SOME SHALLOW EUTROPHIC LAKES, For primary bibliographic entry see Field 5C.
W77-09525

EFFECT OF CRUDE OIL ON POPULATIONS OF BACTERIA AND ALGAE IN ARTIFICIAL PONDS SUBJECT TO WINTER WEATHER AND ICE FORMATION, For primary bibliographic entry see Field 5C.
W77-09526

POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, Environmental Protection Agency, Washington, D.C. Water Quality Office.
For primary bibliographic entry see Field 5G.
W77-09528

FEEDING OF THE KILKA, CLUPEONELLA DELICATULA CASPIA MORPHA TACHARCHALENSIS (BORODIN) IN THE KUIBYSHEV RESERVOIR, (IN RUSSIAN), Akademiya Nauk SSSR, Tolyatti. Institut Biologii Vnutrennykh Vod.
A. V. Kogan, and E. M. Zaitseva.
Vopr Ikhtiol. 14(3), p 477-482, 1974.

Descriptors: Reservoirs, *Food habits, *Freshwater fish, Fish, Daphnia, Waterfleas, *Fish diets, *Fish food organisms.
Identifiers: Acanthocyclops, Bosmina, Chydorus, *Clupeonella delicatula caspia m tsch, *Kilka, *Kuibyshev Reservoir(USSR), Food spectrum, Leptodora, *USSR.

The kilka was first discovered in the Kuibyshev Reservoir (Russian SFSR, USSR) in 1964. With respect to the main meristic and morphological characters, the Kuibyshev kilka is close to the Charkhal kilka *Clupeonella delicatula caspia m. tscharchalensis*, the freshwater form of the common Caspian kilka *C. delicatula caspia*. Information is presented on the food spectrum of the kilka of the Kuibyshev Reservoir. Characteristic foods of the kilka were the older copepodid stages of Cyclopoida, Chydorus, Bosmina, Daphnia, Acanthocyclops and Leptodora. Changes of the food composition of the kilka as it grows were established.—Copyright 1975, Biological Abstracts, Inc.
W77-09540

ARTIFICIAL WATER REGULATION OF LAKE SUPERIOR—A TAKING, Washington Coll. of Law D. C.
For primary bibliographic entry see Field 6E.
W77-09551

FEEDING OF FRY OF VALUABLE FISHES OF THE ARAKUM WATER BODIES AT EARLY STAGES OF DEVELOPMENT AND DEGREE OF SIMILARITY OF THEIR DIET, (IN RUSSIAN), Kaspiiskii Nauchno-Issledovatel'skii Institut Rybnogo Khozyaistva, Makhachkala (USSR). Dagestanskii Div.
O. N. Nasukhov.
Vopr Ikhtiol. 14(3), p 483-491, 1974.

Descriptors: *Fry, Bodies of water, *Fish diets, *Foods, *Freshwater fish, Perches, Habitats, Growth stages, *Fish food organisms.
Identifiers: Arakum, Perca fluviatilis, Rutilus frisii kutum, Rutilus rutilus caspia, Scardinus erythrophthalmus, *USSR, Roach, Kutum, Rudd, *Dagestan ASSR.

The qualitative and quantitative composition of the food of fry of the Caspian roach (*Rutilus rutilus caspia*), kutum (*Rutilus frisii kutum*), rudd (*Scardinus erythrophthalmus*) and perch (*Perca fluviatilis*) in Arakum water bodies (area about 16,000 ha) in the northeastern part of Dagestan ASSR (USSR) was investigated. The degree of similarity of the diet of these fishes at different stages of development was determined. The maximum degree of similarity (61.5-69.2%) was noted in the fry of the kutum and roach, which was attributed to their joint habitation in the better reacted, open areas of water.—Copyright 1975, Biological Abstracts, Inc.
W77-09592

21. Water In Plants

ANNUAL WOODY PRODUCTIVITY DURING A 10-YEAR PERIOD AT VIRELLES-BLAIMONT, (BELGIUM), (IN FRENCH), Brussels Univ. (Belgium). Laboratoire de Botanique Systematique et d'Ecologie.
Paule Kestemont.
Bull Soc R Bot Belg. 107(2), p 233-243, 1974.

Descriptors: *Dendrochronology, *Productivity, *Plant growth, Precipitation(Atmospheric), Annual, Growth rates.
Identifiers: *Belgium(Virelles-Blaimont).

Annual productivity of aerial woody parts was studied for 3 different standing crops in the forest of Virelles-Blaimont. Individual and specific differences, low production during a dry year (1964), high production during moist years (1965 and 1966) were analyzed. Annual production ranged from 5.2 t/ha-11.7 t/ha.—Copyright 1975, Biological Abstracts, Inc.
W77-09143

Field 2—WATER CYCLE

Group 21—Water In Plants

EFFECT OF SEVERAL CULTURAL PRACTICES ON THE ESTABLISHMENT OF ALFALFA (MEDICAGO SATIVA L.).
Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics.
For primary bibliographic entry see Field 3F.
W77-09144

DETERMINATION OF PHYSICAL AND HYDRAULIC PREFERENCES OF BROWN AND BROOK TROUT IN THE SELECTION OF SPAWNING LOCATIONS.
Wyoming Univ., Laramie. Water Resources Research Inst.
D. W. Reiser, and T. A. Wesche.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 273.
Price codes: A06 in paper copy, A01 in microfiche.
Water Resources Series No. 64. May 1977. 100 p.
29 fig, 12 tab, 113 ref, 3 append. OWRD C-7002 (No. 6201)(2), 14-34-0001-6201.

Descriptors: *Spawning, *Brook trout, *Brown trout, *Streamflow, *Aquatic habitats, *Fish behavior, *Wyoming, Incubation, Permeability.
Identifiers: *Spawning criteria, *Spawning behavior, Spawning environment, Spawning flow, Instream flow, Stream resource maintenance flow.

During the fall of 1975, 121 brown and 54 brook trout redds were located and intensively studied in seven stream sections of southeastern Wyoming. Depth, mean velocity, and point velocity were measured at the upper edge, pit, and tailspill of each redd. A representative substrate sample was collected from the tailspill and later analyzed using a series of 9 sieves. Permeability of the substrate was measured at the redd site using a Mark IV standpipe. The distance to the nearest usable cover was also measured for each redd. Spawning criteria were then developed for brown and brook trout using the middle 80 percent of the upper-edge mean velocity measurements, the upper-edge depth which 90 percent of the measurements were greater than or equal to, and the substrate size interval comprising 70 percent of the total weight. For brook trout the criteria were determined to be: velocity, 0.12-1.11 fps; depth, > 0.2 ft; substrate size, 0.132-1.99 in; For brown trout: velocity, 0.45-1.50 fps; depth, > 0.3 ft; substrate size, 0.25-2.99 in. The criteria can be used to aid in determining suitable spawning flows for Wyoming's smaller streams. An egg-planting experiment was conducted to attempt to determine the combination of parameters affording the highest percentage survival of brown trout eggs.
W77-09153

ANNUAL WOODY PRODUCTIVITY DURING A 10-YEAR PERIOD AT MIRWART (BELGIUM), (IN FRENCH).
Brussels Univ. (Belgium). Laboratoire de Botanique Systematique et d'Ecologie.
Paule Kestemont.
Bull Soc R Bot Belg. 107(2), p 223-232, 1974.

Descriptors: *Dendrochronology, *Productivity, Precipitation(Atmospheric), Annual, Dating, Growth rates, *Plant growth.
Identifiers: *Belgium(Mirwart).

Thickening growth ring width was studied in a Fagetum, a Quercetum and a Piceetum established on the same bedrock at Mirwart, Belgium. Specific and individual differences were observed. Characteristic annual productivities (low productivity during 1964 and 1968 corresponding to little precipitation; high productivity in 1962 in relation to abundant precipitation) are discussed.—Copyright 1975, Biological Abstracts, Inc.
W77-09227

GROWTH AND WATER ECONOMY OF THE TREE SPECIES ALNUS AND SALIX, (IN GERMAN).
Freiburg Univ. (West Germany). Institut fuer Biologische Holzforschung.
H. J. Braun.
Z. Pflanzenphysiol. 74(1), p 91-94, 1974.

Descriptors: Trees, *Plant growth, Growth rates, Water consumption, Water conservation, Leaves, *Willow trees.
Identifiers: *Alnus-glutinosa, *Salix-alba.

Amount of basal increment, growth and volume increment of stem, number, area and volume of leaves, water consumption (absolute and per m² leaf area) and water economy during a vegetation period were studied in *Alnus glutinosa* and *Salix alba*. Volume increment (stem and leaves) of *Salix* is only slightly larger than with *Alnus*. *Salix* consumes more water than *Alnus* with the same leaf mass. *Salix* is less economical in its water use than *Alnus*.—Copyright 1975, Biological Abstracts, Inc.
W77-09233

EFFECT OF PARASITES ON THE CONDITION AND GROWTH OF YOUNG FISH OF THE KREMENCHUG RESERVOIR, (IN RUSSIAN).
Akademiya Nauk USSR, Kiev. Instytut Hidrobiologii.
T. I. Komarova, and T. D. Petrichenko.
Gidrobiol Zh. 10(2), p 87-89, 1974.

Descriptors: *Fish parasites, *Growth rates, Reservoirs, Larval growth stage, Trematodes, Juveniles, *Growth stages, Fish hatcheries.
Identifiers: *Bream, *Ergasilus-sieboldi*, *Ichthyophthirius-multifiliis*, Ide, Loach, Silver bream, Trematode, *Trichodina-nigra*, *Tripartiella-incisa*, *Tripartiella-mutabilis*, Dnieper River(USSR).

The effects of some species of parasites on the condition and average daily increment of young fishes of the Kremenchug reservoir on the Dnieper River were studied. Infestation of fish larvae by single specimens of *Trichodina nigra*, *Tripartiella incisa* and *Tripartiella mutabilis* reduced the condition factor of bream by 5.9%, silver bream by 6.8%, loach by 8.0% and ide by 3.0%. With an increase of the intensity of infestation to 15-20 specimens/fish the condition factor decreased respectively by 26.4%, 20%, 18.9% and 18.5%. In the case of combined infestation by these parasites and *Ichthyophthirius multifiliis* the condition factor of the fishes decreased by 20-25%. Not all parasites adversely affected the condition and increment of the fish; e.g., infestation of young fish by various species of trematodes had little effect on them. Infestation by *Ergasilus sieboldi* is also discussed.—Copyright 1975, Biological Abstracts, Inc.
W77-09278

LEAD EFFECTS ON SEVERAL ENZYMES AND NITROGENOUS COMPOUNDS IN SOYBEAN LEAF.
Taiwan Provincial Chung-Hsing Univ., Taichung.
For primary bibliographic entry see Field 5C.
W77-09280

GENOTYPIC RESPONSES IN SORGHUM TO DROUGHT STRESS. III. FREE PROLINE ACCUMULATION AND DROUGHT RESISTANCE.
Agricultural Research Service, Temple, Tex. Blackland Conservation Research Center.
For primary bibliographic entry see Field 3F.
W77-09297

SOIL WATER-ROOT RELATIONS IN WHEAT: WATER EXTRACTION RATE OF WHEAT ROOTS THAT DEVELOPED UNDER DRY AND MOIST CONDITIONS.
Leeds Univ. (England). Dept. of Plant Sciences.

R. B. Sharma, and B. P. Ghildyal.
Agronomy Journal, Vol. 69, p 231-233, March-April 1977. 2 fig, 2 tab, 8 ref.

Descriptors: *Soil water, *Soil-water-plant relationships, *Root systems, *Absorption, *Wheat, Dry farming, Soil moisture, Soil water movement, Clay loam, Root development, Root zone, Plant morphology, Consumptive use.
Identifiers: *Water extraction rate, Soil water tension, Root volume, Root water.

A greenhouse experiment was conducted in Pantnagar, India, to determine whether the root systems of wheat grown under different soil water conditions differed in capacity to extract water from the soil. The water extraction rate per unit root volume was measured for two wheat (*Triticum aestivum* L.) genotypes grown for 60 days after sowing in pots maintained under three soil water tension regimes of 0.3-0.8, 2.0-2.5, and 4.0-4.5 bars. Under study were the one-gene dwarf *Snalika RR-21* and three-gene dwarf *UP 301*; the soil was silty clay loam of the Mollisol order. Sixty days after sowing, the transpirational losses under different soil water tension regimes were measured for 12 days by covering the pots with polyethylene sheet and weighing. Root volume and total root water extracted decreased significantly for both genotypes. Results suggest that root systems which develop under relatively dry soil conditions extract more soil water on a unit root volume basis than those in moist conditions. Findings also indicate that roots under dry conditions develop a more intricate morphology and exploit the soil water more completely. (Jahns-Arizona)
W77-09300

LEAF GROWTH IN RELATION TO ATP LEVELS IN WATER STRESSED CORN PLANTS.
Macquarie Univ., North Ryde (Australia). School of Biological Sciences.
For primary bibliographic entry see Field 3F.
W77-09301

EFFECT OF WATER STRESS DURING DIFFERENT STAGES OF GROWTH OF SOYBEAN.
Pahlavi Univ., Shiraz (Iran).
N. Sionit, and P. J. Kramer.
Agronomy Journal, Vol. 69, p 274-278, March-April 1977. 5 fig, 1 tab, 15 ref.

Descriptors: *Moisture stress, *Plant growth, *Crop response, *Soybean, Water requirements, Drought, Flowering, Germination, Photoperiodism, Seeds, Crop production.
Identifiers: Leaf water potential, Pod formation.

Two varieties of soybean (*Glycine max*, L. Merr.; 'Ransom' and 'Bragg') were studied to determine the effects on yield of controlled water stress at various stages of development. The plants were grown in a controlled environment chamber at 28/17 C with a 8.9-hour photoperiod at 450 hlx and an interrupted dark period which was then suspended for 7 days to induce flowering. Water stress was applied to plant groups during flower induction, flowering, pod formation and pod filling. Leaf water during stress dropped as low as -23 bars but returned to approximately normal after rewetting. Leaves were more susceptible to drought at later stages of growth, probably because they were already approaching senescence. Plants stressed during flower induction and flowering produced fewer flowers, pods and seeds than controls because of a shortened flowering period and abortion of some flowers. The greatest reduction of pods and seeds at harvest was due to stress during early pod formation, but the yield as measured by seed weight was most affected by stress during early formation and pod filling. Stress did not affect the oil or protein content of seeds, although total oil and protein produced per plant were less because of lower seed yields. (Jahns-Arizona)

W77-09302

SORGHUM GENOTYPE VARIATION IN STOMATAL SENSITIVITY TO LEAF WATER DEFICIT.

Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
R. G. Henzell, K. J. McCree, C. H. M. Van Bavel, and K. F. Schertz.
Crop Science, Vol. 16, p 660-662, Sept-Oct. 1976. 2 fig, 2 tab, 15 ref.

Descriptors: *Grain sorghum, *Stomata, *Moisture stress, *Crop response, *Drought resistance, Leaves, Plant physiology, Water utilization, Conductivity, Adaptation, Genetics.
Identifiers: *Genotype, *Stomatal sensitivity, Leaf water potential, Leaf diffusive resistance, Stomatal conductance.

Four sorghum (*Sorghum bicolor* (L.) Moench) genotypes progressively stressed for moisture in a growth chamber at College Station, Texas, were studied to determine the relationship between leaf diffusive resistance and leaf water potential. The four genotypes tested covered the stomatal sensitivity range reported by Henzell et al (1975). Stomatal conductance of leaves of 'Alpha' and 'Shallu' declined rapidly as leaf water potential dropped, while declines were slower in 'LS1598C' and 'M35-1'. Behavior of F1 hybrids was generally similar to their most sensitive parent, but the correspondence was not consistent. The relevance of differences in stomatal sensitivity for drought resistance is discussed. Such sensitivity may be an important element of intergenotype variation in drought resistance; however, there may be other criteria for distinguishing genotypes in terms of adaptation to drought conditions. (Jahns-Arizona) W77-09303

STAND ESTABLISHMENT OF WHEAT LINES UNDER DIFFERENT LEVELS OF WATER POTENTIAL.

Kabul Univ. (Afghanistan). Faculty of Agriculture.
For primary bibliographic entry see Field 3F.
W77-09304

INFLUENCE OF INDETERMINATE GROWTH HABIT ON YIELD AND IRRIGATION WATER-USE EFFICIENCY IN UPLAND COTTON.

Agricultural Research Service, Lubbock, Tex. Oklahoma-Texas Area.
For primary bibliographic entry see Field 3F.
W77-09306

EFFECTS OF CONDENSED PHOSPHATES ON PLANT GROWTH AND PHOSPHORUS UPTAKE.

Edinburgh Univ. (Scotland). School of Agriculture.
For primary bibliographic entry see Field 3F.
W77-09307

MEASUREMENT OF WATER FLUXES AND POTENTIALS IN A SINGLE ROOT-SOIL SYSTEM I. THE TENSIO-METER-POT-METER SYSTEM.

University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.
H. B. So, L. A. G. Aylmore, and J. P. Quirk.
Plant and Soil, Vol. 45, p 577-594, 1976. 12 fig, 4 tab, 17 ref.

Descriptors: *Root systems, *Water measurement, *Tensiometers, *Soil water movement, *Phytometers, Xylem, Soil-water-plant relationships, Steady flow, Root zone, On-site tests.
Identifiers: *Water flux, Root water potential.

The construction and operation of a tensiometer-potometer system which can measure xylem water

potential, root-soil interface water potential, and flux of water for a plant root subjected to steady state conditions is described. Using hybrid maize seedlings, experiments were conducted to test the tensiometer response time and the response to root water potential changes. Response time of the tensiometer-root system depends on the flux of water into the root; the tensiometer was more suitable for steady state than transient conditions. It was also demonstrated that a unique linear relationship exists between the resistance to water flow and root tissue water status. (Jahns-Arizona) W77-09308

EFFECTS OF DROUGHT AND SALINITY ON SOME GROWTH CONTRIBUTING PARAMETERS IN WHEAT AND BARLEY.

Assiut Univ. (Egypt). Dept. of Botany.
For primary bibliographic entry see Field 3C.
W77-09312

THE EFFECTS OF DRYING OF THE TOPSOIL AND OF MICRONUTRIENTS IN THE SUBSOIL ON MICRONUTRIENT UPTAKE BY AN INTERMITTENTLY DEFOLIATED RYEGRASS.

Adelaide Univ. (Australia). Dept. of Agronomy.
E. K. S. Nambiar.
Plant and Soil, Vol. 46, p 185-193, 1977. 6 tab, 5 ref.

Descriptors: *Topsoil, *Drying, *Nutrient requirements, *Soil investigations, *Absorption, *Australia, Soil-water-plant relationships, Soil management, Deficient elements, Manganese, Dry farming, Wilting, Crop production, Mulching, Zinc, Copper.
Identifiers: *Micronutrient uptake, *Ryegrass, Defoliation, Dry matter yield.

A greenhouse experiment was conducted in South Australia to determine the effects of topsoil water content on the micronutrient uptake of Italian ryegrass (*Lolium multiflorum* Lam.) grown in a siliceous sandy soil of marginal micronutrient status. Without micronutrient supplies from deeper layers, topsoil drying after defoliation reduced dry matter yield by causing micronutrient deficiency, especially of manganese. Yield reductions were slight when small amounts of micronutrients were added to the lower compartment 7 days after the commencement of drying. Mulching of the soil also reduced yield losses after drying but was not as effective as micronutrient supply. The benefit from adding micronutrients appears related to manganese supply; improved micronutrient supply in the lower layer enhanced the efficiency of manganese absorption from dry topsoil. As long as roots have access to water in the subsoils, significant amounts of manganese, zinc and copper can be absorbed from topsoils as dry or drier than wilting point. (Jahns-Arizona) W77-09314

A TRANSPORT KINETIC CONCEPT FOR ION UPTAKE BY PLANTS. III. TEST OF THE CONCEPT BY RESULTS FROM WATER CULTURE AND POT EXPERIMENTS.

Royal Veterinary and Agriculture Coll., Copenhagen (Denmark). Dept. of Soil Fertility and Plant Nutrition.
N. E. Nielsen.
Plant and Soil, Vol. 45, p 659-677, 1976. 3 fig, 10 tab, 11 ref, append.

Descriptors: *Hydraulic models, *Model studies, *Absorption, *Ion transport, Plant growth, Copper, Barley, Aqueous solutions, Soil-water-plant relationships.
Identifiers: *Transport kinetic model(Plants), Michaelis-Menton Constant, Mean Maximal Rate.

A previously proposed transport kinetic model for ion uptake by plants was tested using data for copper uptake by barley grown in soil or water culture and corresponding data for copper concentra-

tion in the soil or culture solutions. Experimental results were consistent with the values calculated by using the model, which allows the Michaelis-Menton Constant (Km) of ion uptake and the Mean Maximal Rate of ion uptake to be calculated for various time intervals of the plants' growth periods. Results indicate that the rate of copper uptake by whole plants and that by aerial parts from soil and water culture can be expressed as a function of the copper concentration in the bulk-solution by using the proposed equations. The Km values for copper uptake by barley grown in soil and in water culture were the same if the chemical composition of both solutions was the same. Copper concentrations in the soil solution, where the copper uptake rate was zero, were 2-4 times greater than corresponding values in water culture solution. (Jahns-Arizona) W77-09315

EXPERIENCE IN USING PARASITES FOR A QUANTITATIVE EVALUATION OF FISH FEEDING. (IN RUSSIAN).

Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
B. I. Kuperman.
Vopr Ikhtiol 15(5), p 931-934, 1975.

Descriptors: *Fish diets, *Indicators, Worms, *Fish parasites, Carp, Oligochaetes, Perch, Pike.
Identifiers: *Acerina-Cernua*, *Cestode*, *Eubothrium-Rugosum*, *Lota-Lota*, *Perca-Fluviatilis*, *Triaenophorus-Crassus*, *Triaenophorus-Nodulosus*, *Tapeworms.

Using the tapeworm *Eubothrium rugosum* as an indicator of the feeding of the burbot (*Lota lota*) it was established that parasites can serve as an objective index of not only the qualitative but also the quantitative characteristics of fish feeding. Using the tapeworms *Triaenophorus nodulosus* and *T. crassus* the number of perch (*Perca fluviatilis*) and ruff (*Acerina cernua*) eaten by pike can be estimated; cestodes of the family Caryophyllidae can serve as an indicator of the consumption of Oligochaeta by carp, etc.—Copyright 1976, Biological Abstracts, Inc.
W77-09400

HELMINTH FAUNA OF BELONIFORM FISH. (IN RUSSIAN).

Institute of Biology of the Southern Seas, Sevastopol (USSR).
A. M. Parukhin.
Gidrobiol Zh. 9(3), p 58-64, 1973.

Descriptors: *Fish parasites, *Worms, Larvae.
Identifiers: *Ablennes-Hians*, *Belone-Belone*, *Beloniform fish, Carnivorous fish, *Cypselurus-Bachyensis*, *Cypselurus-Furcatus*, *Cypselurus-Robustus*, *Cypselurus-Spp.*, *Euleptorhamphus-Brevortii*, *Euleptorhamphus-Longirostris*, *Exocoetus-Obtusirostris*, *Exocoetus-Volitans*, *Hemirhamphus-Marginatus, *Hyporhamphus-Balinensis*, *Parexocoetus-Brachypterus*, *Scomberesox-Saurus*, *Thylosurus-Crocodylus*.

A comparative analysis of parasitic worm fauna of 4 Beloniform families (*Exocoetidae*, *Hemirhamphidae*, *Belonidae* and *Scomberosocidae*) showed specific helminth associations within each family, that were considered to be related to host habitat and food. A wide variety of helminth larvae were found. Beloniforms serve as an additional host for helminths, whose adult stages infest large carnivorous fishes. The species examined were *Exocoetus volitans*, *E. obtusirostris*, *Cypselurus bachyensis*, *C. robustus*, *C. furcatus*, *Cypselurus spp.*, *Parexocoetus brachypterus*, *Euleptorhamphus longirostris*, *E. brevortii*, *Hemirhamphus marginatus*, *Hyporhamphus balinensis*, *Ablennes hians*, *Thylosurus crocodylus*, *Belone belone*, and *Scomberesox saurus*.—Copyright 1975, Biological Abstracts, Inc.
W77-09403

Field 2—WATER CYCLE

Group 21—Water In Plants

FOREST SITE CONDITIONS OF BARCHANS UNDERLAIN BY TAKYRS, (IN RUSSIAN), Desert Inst., Ashkhabad (USSR).
For primary bibliographic entry see Field 2G.
W77-09497

ESTABLISHING ARTIFICIAL PASTURES AND MEADOWS IN THE CHARTAK ADYRS OF THE FERGANA VALLEY, (IN RUSSIAN), Akademiya Nauk Uzbekskoi SSR, Tashkent. Institut Bataniki.
O. Kh. Khasanov, R. S. Vernik, A. Usmanaliev, and E. Abdullazhanov.
Probl Osvoeniya Pustyn'. 6, p 68-71, 1973.

Descriptors: *Pastures, *Meadows, *Desert plants, *Root systems, Drought, Drought resistance, *Plant growth, Arid lands, Planting management.
Identifiers: Adyrs, Artificial pastures, Fergana, *Onobrychis-ferganica, USSR.

Rapid growth and efficient root system of desert and semi-desert plants were established as the principal biological features of plant resistance to soil drought and high atmospheric temperatures. Some soft-stem species (Onobrychis ferganica) are recommended for pasture improvement. The plants complete vegetational cycle and form considerable amounts of overground mass before drought occurs.—Copyright 1975, Biological Abstracts, Inc.
W77-09498

ALGOFLORA OF SOME DRAINAGE CANALS OF THE CHARDZHOU OBLAST, (IN RUSSIAN), Izv Akad Nauk Turkm SSR Ser Biol Nauk 1, p 17-22, 1976.

Descriptors: Canals, *Aquatic algae, *Systematics, Drainage systems, Algae, *Diatoms, *Benthic flora, Phytoplankton.
Identifiers: *Chardzhou Oblast(USSR), Oblast, *USSR, Turkmen SSR.

Specific and intraspecific taxa of algae (263) were recorded in drainage canals of the Turkmen SSR (USSR) Chardzhou region, diatomic forms being in excess (up to 70%). As for the cenotic aspects, benthic and epiphytic forms predominate. Phytoplankton is poorly developed. The distinctive feature of the drainage system algoflora is a predominance of diatomic forms in all the seasons of the year.—Copyright 1977, Biological Abstracts, Inc.
W77-09508

ELEVATED SUCTION TENSIONS AND MORPHOLOGICAL ALTERATIONS CAUSED BY TRANSVERSE CUTS IN A TAXUS STEM, (IN GERMAN), Hochschule fuer Bodenkultur, Vienna (Austria). Botanisches Institut.
H. Richter.
Flora (Jena). 163(4), p 291-309, 1974.

Descriptors: *Stemflow, *Trees, *Transpiration, *Vapor pressure, *Moisture uptake, Specific conductivity, Plant morphology.
Identifiers: Morphological consequences(Trees), *Suction tension(Trees), Taxus baccata, Transpiration resistance.

The influence of SR (frictional tension due to water movement in soil and plant) on total potentials in the crown of a large tree may be simulated experimentally by means of a double sawcut in the stem of a small tree, which increases transport resistances of the conduit. Such an experiment was set up with a large bush of yew (T. baccata L.), and suction tensions were followed with a pressure bomb. Diurnal courses of suction tensions are presented for typical days. Tensions were always higher in the experimental part than in the control,

but the extent of the difference depended on the climatic conditions. Values in the control reached a minimum in the late evening, while those in the experimental twigs continued to decline during the night. An eventual coincidence of the 2 curves was prevented by the onset of transpiration in the morning. Tensions in the control followed changes in the vapor pressure deficit rather closely, while the experimental part showed a tendency to hold a plateau value at about 21 atm under different atmospheric conditions. Thus, maximum tension differences occurred whenever there was a sudden fall in delta p (vapor pressure deficit) values. Such a situation led to a rapid tension drop in the control twigs, while the experimental parts remained at their previous high level, sometimes for a prolonged period. Differences in the tension pattern similar to those described may play an important role in the establishment of physiological and morphological differences between the lower and upper crown of a high tree. Shoot and needle lengths and needle distances were compared for experimental and control parts. The results agree with previous work on artificial drought and its morphological consequences in conifers. Since in most earlier experiments drought was induced in young plants by means of infrequent irrigation, the similarity of results obtained in an old tree by the sawcut technique seems to be of some significance.—Copyright 1975, Biological Abstracts, Inc.
W77-09530

SECONDARY AUTUMN SHOOT FORMATION IN SPRING WHEAT: I. THE ROLE OF DROUGHT DAMAGE AND DEVELOPMENTAL STAGES, (IN RUSSIAN), Akademiya Nauk SSSR, Novosibirsk. Inst. of Soil Sciences and Agrochemistry.
S. S. Mordkovich, and S. A. Mokridova.
Izv Sib Otd Akad Nauk Sssr Ser Biol Nauk 3, p 107-115, 1974.

Descriptors: *Wheat, Drought, *Drought resistance, *Plant growth, *Growth rates, Growth stages, Seasonal, Autumn, *Temperature.

The significance of high temperatures was indicated in experimental drought conditions during the basic development stages of wheat in subsequent sprout formation of the secondary growth. Secondary sprouts were formed from aboveground nodes; they were characterized by extremely rapid growth and development, reduced size of straw and foliar surface.
W77-09545

2J. Erosion and Sedimentation

A SEDIMENT TRANSPORT MODEL FOR STRAIGHT ALLUVIAL CHANNELS, Technical Univ. of Denmark, Copenhagen. Inst. of Hydrodynamics and Hydraulic Engineering.
F. Engelund, and J. Fredsoe.
Nordic Hydrology, Vol. 7, No. 5, p 293-306, 1976. 4 fig, 20 ref.

Descriptors: *Sediment transport, *Alluvial channels, *Model studies, *Mathematical models, Suspended load, Suspended solids, Bed load, Sedimentation, Rivers, Erosion, Flow, Streamflow, Particle size, Sands, Sediment loads, Tractive forces, Transfer, Sedimentation.

A simple mathematical model for sediment transport in straight alluvial channels is presented. The model, which is based on physical ideas related to those introduced by Bagnold, was originally developed in two steps, the first describing the bed load transport and the second accounting for the suspended load. The model was assumed to have two advantages as compared with empirical models: first, it is based on a description of physical processes, second, it gives some information about the quantity and size of the sand particles in suspension and the bed particles. (Sims-ISWS)

W77-09104

RECORDING RIVER AND RESERVOIR WATER DEPTH, Moore, Gardner and Associates, Inc., Asheboro, N. C.
For primary bibliographic entry see Field 7B.
W77-09106

PROFILE DESATURATION DURING SEDIMENT DEPOSITION IN A GROUNDWATER RECHARGE TRENCH, Mississippi Agricultural and Forestry Experiment Station, Mississippi State. Dept. of Agronomy.
For primary bibliographic entry see Field 4B.
W77-09115

HERBICIDES FROM CROPPED WATERSHEDS IN STREAM AND ESTUARINE SEDIMENTS IN HAWAII, Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 5B.
W77-09129

LOCATION OF MAJOR DELTAS, Imperial Coll. of Science and Technology, London (England). Dept. of Geology.
For primary bibliographic entry see Field 2L.
W77-09133

EROSION CAUSED BY INTENSE RAINFALL IN A SMALL CATCHMENT IN NEW YORK STATE, Clark Univ., Worcester, Mass. Graduate school of Geography.
W. H. Renwick.
Geology, Vol 5, No 6, p 361-364, June 1977. 4 fig, 3 tab, 17 ref.

Descriptors: *Excessive precipitation, *Rainfall, *New York, *Erosion, *Gullies, Thunderstorms, Precipitation(Atmospheric), Landslides, Debris avalanches, Erosion, Sediments, Sedimentation, Watersheds(Basins), Flood plains, Streams, Alluvial fans, Channels, Channel erosion, Cloud-bursts, Slopes, Storms.
Identifiers: *Fall Creek(NY).

This paper described landslides and debris flows triggered by intense rainfall in a very small gully in New York State. The incised channel is 150 m long, and 500 cu m of material were removed in one event, amounting to about 1% of the total volume of the gully. Large amounts of very coarse material were transported from the tributary to the floodplain of the larger stream. Although such events are relatively infrequent, they are an essential link in the total system of sediment movement, including both the enlargement of the gully and the addition of coarse debris to the larger stream. Long-term processes such as weathering and creep are important in making material available for transport in extreme events. Different parts of the sediment movement system function at different spatial and temporal frequencies, and the interaction of these parts may be masked in data on total basin output. It was suggested that more attention should be focused on subsystem interactions of this type in studies of drainage basin dynamics. (Sims-ISWS)
W77-09134

EFFECTS OF IMPOUNDMENT ON WATER AND SEDIMENT IN THE ARKANSAS RIVER AT PUEBLO RESERVOIR, University of Southern Colorado, Pueblo.
For primary bibliographic entry see Field 5B.
W77-09224

A PEBBLE-COBBLE DEPOSIT IN MONTEREY BAY, CALIFORNIA.
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 2L.
W77-09228

PHOTOGRAPHIC RECONNAISSANCE OF CONTINENTAL SLOPE AND UPPER CONTINENTAL RISE,
Lamont-Doherty Geological Observatory,
Palisades, N.Y.
For primary bibliographic entry see Field 5B.
W77-09247

SPLASH EROSION OF PRIMARY PARTICLES AND AGGREGATES,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Soils.
P. I. A. Kinnell.
Soil Science Society of America Journal, Vol. 40,
No. 6, p 966-968, November-December 1976. 1 fig,
1 tab, 3 ref.

Descriptors: *Erosion, Rainfall, Soils, Soil properties, Soil investigations, Soil tests, Precipitation (Atmospheric), *Raindrops, *Impact (Rainfall).
Identifiers: *Splash erosion.

The previously supposed similarity between primary particles and aggregates in resisting splash erosion was shown to be partially incorrect. Mathematical treatment of splash-cup data on which the earlier conclusion was based showed that for surfaces containing aggregates, the quantity of material lost per unit quantity of artificial rainfall varied with rainfall intensity; a result which contrasts to observations for primary particles. (Skogerboe-Colorado State)
W77-09288

COMMENTS ON THE MECHANISM OF SOIL DETACHMENT BY RAINFALL,
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 2G.
W77-09313

PROCEEDINGS OF THE EIGHTH DREDGING SEMINAR.
Texas A and M Univ., College Station. Center for Dredging Studies.
For primary bibliographic entry see Field 2L.
W77-09325

FINE-GRAINED SEDIMENT AND INDUSTRIAL WASTE DISTRIBUTION AND DISPERSAL IN NEW BEDFORD HARBOR AND WESTERN BUZZARDS BAY, MASSACHUSETTS,
Woods Hole Oceanographic Institution, Mass.
Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W77-09326

THE CITIZEN'S GUIDE TO NORTH CAROLINA'S SHIFTING INLETS,
North Carolina State Univ. at Raleigh. Center for Urban Affairs and Community Services.
For primary bibliographic entry see Field 2L.
W77-09327

PERFORMANCE ANALYSIS OF A TETHERED FLOAT BREAKWATER,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 8B.
W77-09328

ESTIMATING THE SUSPENDED SEDIMENT LOAD IN RESERVOIRS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
J. R. McHenry, J. C. Ritchie, and F. R. Schiebe.
Water Resources Bulletin, Vol. 12, No. 6, p 81-92,
December 1976. 3 fig, 5 tab, 12 ref.

Descriptors: *Reservoir silting, *Mississippi, *Sedimentation, *Suspended load, Suspended solids, Remote sensing, Reservoirs, Sediment transport, Hydrology, Equations, *Estimating.
Identifiers: *Suspended sediment concentration, Reflect solar radiation, Sediment measurement.

The total suspended sediment loads of four north Mississippi reservoirs were determined from measurements of concentrations of suspended sediment in a vertical profile at several locations on each reservoir made during the year. The data were combined with the state-height and known stage-volume relationships for each reservoir in a numerical integration to determine the total suspended sediment in the water body. Total suspended sediments were estimated using the product of the suspended sediment concentration in the surface water by the appropriate reservoir volume. The averaged ratios of the estimated to measured suspended sediment loads for each reservoir exceeded 0.90. Since the concentration of suspended sediments in surface waters of north Mississippi reservoirs has been shown as highly correlated with spectral reflectance, estimating the total suspended sediment of these reservoirs using remotely sensed spectral reflectance data is possible. (Lee-ISWS)
W77-09331

USE OF LARGE SUBMERGED CHAMBERS TO MEASURE SEDIMENT-WATER INTERACTIONS,
Great Lakes Basin Commission, Ann Arbor, Mich.
For primary bibliographic entry see Field 5B.
W77-09343

LACUSTRINE SEDIMENTS IN THE ALLEGHENY PLATEAU OF ERIE COUNTY, NEW YORK: THEIR CHARACTERISTICS, DISTRIBUTION, AND LAND USE PROBLEMS,
Cornell Univ., Ithaca, N.Y. Agricultural Experiment Station.
D. W. Owens, R. B. Daniels, and G. B. Brauen.
Journal of Soil and Water Conservation, Vol. 32,
No. 2, p 93-97, March-April, 1977. 6 fig, 2 tab, 8 ref.

Descriptors: *Soils, *Sediments, *Land use, *New York, Lake sediments, Soil types, Glaciers, Geomorphology, Glacial soils, Mass transfer, Landslides, Hazards, Construction, Geology, History.
Identifiers: *Allegheny Plateau (NY), *Erie County (NY), Lacustrine sediments.

Temporary glacial lakes developed in many Allegheny Plateau river valleys 12,000 to 13,000 years ago when glacial ice dammed the north-flowing streams. The lakes were only 1 to 2 miles wide and 5 to 10 miles long, but more than 100 feet of illitic lacustrine silts and clays were deposited in some of the valleys before the lakes were drained. In most areas, 2 to 10 feet of sand and gravel were deposited over the lacustrine materials shortly after the lakes were drained. Erosion since the glacial ice melted has cut into the glacial, glaciofluvial, and lacustrine sediments in the narrow valleys, resulting in extremely complex but predictable soil patterns. A thorough knowledge of the glacial geology of the area is needed to map the areas underlain by lacustrine sediments because most soils are formed in the sand and gravel of the glaciofluvial cap. Many of the areas underlain by lacustrine sediments would be missed if only the surficial soil properties were used. The steep slopes underlain by lacustrine sediments are attractive building

sites because they are close to ski resorts, they are visually pleasant most of the year, and they are near a large city with an expanding urban population. But large areas of the most attractive building sites are on or close to steep slopes that are subject to mass movement when disturbed by normal building activities. Building on the unstable materials has resulted in considerable difficulty in maintaining the roadbed of a railroad and roads and in maintaining utility lines and foundations in a housing development. (Sims-ISWS)
W77-09357

A PORTABLE RAINFALL SIMULATOR FOR ERODIBILITY AND INFILTRATION MEASUREMENTS ON RUGGED TERRAIN,
Klamath National Forest, Yreka, Calif.
J. R. Munn, Jr., and G. L. Huntington.
Soil Science Society of America Journal, Vol. 40,
No. 4, p 622-624, July-August 1976. 1 fig, 1 tab, 17 ref.

Descriptors: *Erosion, *Infiltration, *Rainfall simulators, Rainfall-runoff relationships, Rainfall.

A portable rainfall simulator for field study of erosion potential and infiltration on mountainous terrain is described. Polyethylene tubes produce 3.2-mm drops which fall 2.5 m onto a 61 by 61 cm plot. The maximum rainfall intensity is 23 cm/hour. A 16% intensity variation across the plot area was measured, but the variation between separate simulated storms was < 1% for identical intensity settings. The unit is suited to one man operation on slopes up to 60%. (Skogerboe-Colorado State)
W77-09441

THERMAL CONDUCTIVITY OF ORGANIC SEDIMENTS FROM TWO WISCONSIN LAKES,
Cold Regions Research and Engineering Lab., Hanover, N.H. Earth Sciences Branch.
R. McGaw.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-025 086. Price codes: A02 in paper copy, A01 in microfiche. USA CRREL Special Report 129, November 1974. 14 p, 10 fig, 2 tab, 9 ref. DA-IT-061102-B-52-A-02.

Descriptors: *Thermal conductivity, *Lake sediments, *Organic matter, *Wisconsin, Cold regions, On-site investigations.
Identifiers: *Stewart's Dark Lake (Wis), *Tub Lake (Wis).

Thermal conductivities of four specimens from partially-gelatinous bottom sediments in Stewart's Dark Lake and Tub Lake, in northwestern Wisconsin, were measured to learn whether adding gelatinous or amorphous organic matter to water would raise or lower the conductivity. One specimen was taken from the center of each lake and the other represented sediments near the shore. The probe used is shown schematically and consists of a stainless steel sheath enclosing a heating coil of constantan wire within which is mounted a chromel/constantan thermocouple at mid-length. A molded plastic connector supports the thermocouple and power leads. Free length below the connector is 21 cm whereas the outer diameter of the sheath is 0.5 mm. Length/diameter ratio is approximately 420. The test indicated that fibrous organic material decreases conductivity to below that of water. The thermal conductivity of a fibrous sediment appears to be independent of increased heat flow. The conductivity of a gelled sediment approaches the conductivity of water as heat flow is increased. (Auen-Wisconsin)
W77-09521

Field 2—WATER CYCLE

Group 2K—Chemical Processes

2K. Chemical Processes

THE AGE OF GROUNDWATER IN THE LINCOLNSHIRE LIMESTONE, ENGLAND AND ITS RELEVANCE TO THE FLOW MECHANISM, Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 2F.
W77-09107

PLEISTOCENE ICE AT THE BASE OF THE BARNES ICE CAP, BAFFIN ISLAND, N.W.T., CANADA, Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2C.
W77-09116

EXTRACTION OF TRACE COMPONENTS FROM LARGE QUANTITIES OF ICE IN BORE HOLES, Bern Univ. (Switzerland). Physikalisches Institut.
For primary bibliographic entry see Field 2C.
W77-09121

A METHOD OF CONCENTRATING THE MAJOR IMPURITIES CONTAINED IN ICE BY ION EXCHANGE, Grenoble-1 Univ. (France). Institut de Geographie Alpine.
For primary bibliographic entry see Field 2C.
W77-09122

MICRONUTRIENT ANALYSIS OF SEAWATER SAMPLES TAKEN AT DEEPWATER DUMPSITE 106--MAY 1974, National Marine Fisheries Service, Narragansett, R.I. MARMAP Field Group.
For primary bibliographic entry see Field 5A.
W77-09250

ANALYTICAL RESULTS FOR WATER-COLUMN SAMPLES COLLECTED AT DEEP-WATER DUMPSITE 106--MAY 1974, Environmental Protection Agency, Edison, N.J. Technical Support Group.
For primary bibliographic entry see Field 5A.
W77-09251

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 1, Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09259

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 2, Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09260

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 3, Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09261

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 4, Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09262

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 5, Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09263

THE CHEMICAL COMPOSITION OF THE LYSIMETRIC WATER FROM SANDY PODZOLIC SOIL AND CHANGES AFFECTED BY FERTILIZERS, (IN RUSSIAN), Leningrad State Univ. (USSR).
N. M. Shakhova, and E. I. Shilova.
Vestn Leningr Univ Ser Biol. 28(4), p 119-124, 1973.

Descriptors: Lysimeters, Sands, Podzols, Pine trees, Fertilizers, Chemical analysis, Acidity, *Carbamate pesticides, Acidic soils, Ions, Calcium, Phosphates, Chlorides, Ammonium, Potassium.

Lysimetric solutions of sandy podzolic soil forming under 8-yr-old pines have low concentration and high acidity, mainly due to non-volatile acids. The application of carbamide leads to abrupt increase of general concentration of the litter solution and displacement of the pH value towards the neutrality. The carbamide together with the superphosphate and KCl increases the acidity of the solution, its general concentration and the content of ions Ca^{++} , K^{+} , NH_4^{+} and Cl^{-} . Copyright 1974, Biological Abstracts, Inc.
W77-09277

BEHAVIOR OF CHROMIUM IN SOILS: II. HEXAVALENT FORMS, Vermont Univ., Burlington. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 2G.
W77-09283

POTASSIUM STATUS OF SOME ALLUVIAL SOILS IN KENTUCKY, Kentucky Univ., Lexington. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09290

CALCIUM RETENTION IN RESPONSE TO PHOSPHATE SORPTION BY SOILS, Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09291

CORRECTION OF 'TUBE CONTRIBUTION' INTERFERENCE IN THE DETERMINATION OF HEAVY METALS BY X-RAY SPECTROSCOPY USING THE 'ADDITIONS TECHNIQUE', Maryland Agricultural Experiment Station, College Park. Dept. of Soil Science.
For primary bibliographic entry see Field 5A.
W77-09292

A SEMIAUTOMATED PROCEDURE FOR TOTAL NITROGEN IN PLANT AND SOIL SAMPLES, Florida Univ., Gainesville. Dept. of Agronomy.
R. N. Gallaher, C. O. Weldon, and F. C. Boswell.
Soil Science Society of America Journal, Vol. 40, No. 6, p 887-889, November-December 1976. 2 fig, 1 tab, 12 ref.

Descriptors: *Nitrogen, Laboratory tests, Laboratories, Soil investigations, Soil properties, Pollutant identification, Automation, Soil analysis, Soil chemistry, Plant physiology.
Identifiers: *Total nitrogen determination.

This study evaluated inexpensive alternatives for the determination of total N in plant and soil samples. Plant and soil samples which varied widely in

N concentration were digested in a 126-sample-capacity Al block digester followed by determination of total N with the ammonium electrode in a semiautomated reaction vessel assembly. The proposed Ammonium electrode semiautomated (AES) procedure was compared to standard micro-Kjeldahl and aluminum block digested-steam distilled-titrated (ABDDT) procedures. Thirty to 50 more samples could be analyzed per 8-hour day with the proposed semiautomated procedure as compared to standard micro-Kjeldahl methods. The precision of the methods were comparable but significantly more N was found by using the ABDDT procedure. (Skogerboe-Colorado State)
W77-09294

AN IMPROVED TECHNIQUE FOR MEASURING SOIL PH, Montana Agricultural Experiment Station, Bozeman.
For primary bibliographic entry see Field 2G.
W77-09295

PRECIPITABLE WATER VAPOR IN ATMOSPHERES CHARACTERIZED BY TEMPERATURE INVERSIONS, Consiglio Nazionale della Ricerche, Bologna (Italy). Sezione Microfisica dell'Atmosfera.
For primary bibliographic entry see Field 2B.
W77-09330

CHEMICAL REDUCTION OF NITRATE BY FERROUS IRON, North Dakota State Univ., Fargo. Dept. of Soils.
For primary bibliographic entry see Field 5A.
W77-09426

BEHAVIOR OF CHROMIUM IN SOILS: I. TRIVALENT FORMS, Vermont Univ., Burlington. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 2G.
W77-09432

A METHOD FOR SECTIONING SATURATED SOIL CORES, Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09436

NITRIFICATION-DENITRIFICATION REACTIONS IN FLOODED SOILS AND WATER BOTTOMS: DEPENDENCE ON OXYGEN SUPPLY AND AMMONIUM DIFFUSION, Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09437

ADSORPTION OF SELENITE AND PHOSPHATE ON AN ALLOPHANE CLAY, Ruakura Agricultural Research Center, Hamilton (New Zealand). Soil Chemistry Group.
For primary bibliographic entry see Field 2G.
W77-09439

HETEROVALENT CATION EXCHANGE EQUILIBRIA IN SOILS WITH VARIABLE AND HETEROGENEOUS CHARGE, California Univ., Davis. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09440

IN SITU MEASUREMENT OF GAS DIFFUSION COEFFICIENT IN SOILS, Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 2G.

W77-09442

2L. Estuaries**HYDROGRAPHIC SURVEYING TURNS TO ELECTRONICS,**

Tibbetts Abbott, McCarthy and Stratton, Seattle, Wash.

For primary bibliographic entry see Field 7B.
W77-09105**HERBICIDES FROM CROPPED WATERSHEDS IN STREAM AND ESTUARINE SEDIMENTS IN HAWAII,**

Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.

For primary bibliographic entry see Field 5B.
W77-09129**AN ASSESSMENT OF WATERSPOUT FREQUENCIES ALONG THE U.S. EAST AND GULF COASTS,**

National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Lab.

For primary bibliographic entry see Field 2B.
W77-09130**DECLINING POTENTIOMETRIC LEVELS IN FORT WALTON BEACH AREA, FLORIDA,**

Northwest Florida Water Management District, Tallahassee.

For primary bibliographic entry see Field 4B.
W77-09132**LOCATION OF MAJOR DELTAS,**

Imperial Coll. of Science and Technology, London (England). Dept. of Geology.

M. G. Audley-Charles, J. R. Curray, and G. Evans. *Geology*, Vol 5, No 6, p 341-344, June 1977. 2 fig, 1 tab, 18 ref.

Descriptors: *Deltas, *Rivers, *Drainage systems, Coasts, Sites, Geology, Erosion, Sedimentation, Geologic history, Geomorphology, Folds(Geologic), Drainage.

Identifiers: *Delta locations, Tectonic settings, Major deltas.

Analysis of major modern deltas in terms of drainage patterns supplying the delta and the tectonic setting of the deltaic accumulation revealed that there are four principal types: namely, (1) intracratonic, (2) rifted-continental-margin deltas with either Afrottype or Amerotype drainage, (3) marginal-basin deltas, and (4) deltas at the boundary between a craton and Mesozoic-Cenozoic orogenic belts with grain-parallel drainage. The different types of delta are expressed in the character of their basement and the lithostratigraphy of their deltaic pile. Recognition of the different delta types is useful for predicting the paleogeographic situation and structural history of ancient deltas. (Sims-ISWS)

W77-09133

PHOSPHATE AND TRIPOLYPHOSPHATE ADSORPTION BY CLAY MINERALS AND ESTUARINE SEDIMENTS,

Virginia Inst. of Marine Science, Gloucester Point.

For primary bibliographic entry see Field 5C.
W77-09152**A MULTI-PARAMETER ESTUARY MODEL,**

Tetra Tech., Inc., Lafayette, Calif.

For primary bibliographic entry see Field 5B.
W77-09165**MATHEMATICAL MODEL OF A GREAT LAKES ESTUARY,**

Environmental Protection Agency, Chicago, Ill.

For primary bibliographic entry see Field 5B.
W77-09166

FEDBAK03 - A COMPUTER PROGRAM FOR THE MODELLING OF FIRST ORDER CONSECUTIVE REACTIONS WITH FEEDBACK UNDER A STEADY STATE MULTIDIMENSIONAL NATURAL AQUATIC SYSTEM,
Environmental Protection Agency, New York. Data Systems Branch.

For primary bibliographic entry see Field 5B.
W77-09176**A COMPUTER MODELING STUDY TO ASSESS THE EFFECTS OF A PROPOSED MARINA ON A COASTAL LAGOON,**

Connell/Metcalf and Eddy, Coral Gables, Fla.

For primary bibliographic entry see Field 5C.
W77-09194**A PEBBLE-COBBLE DEPOSIT IN MONTEREY BAY, CALIFORNIA,**

Naval Postgraduate School, Monterey, Calif.

M. J. Malone.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A021 297, Price codes: A03 in paper copy, A01 in microfiche. Master's Thesis, June 1970. 46 p, 10 fig, 3 tab, 18 ref.

Descriptors: *Baseline studies, *Continental Shelf, *California, Water resources, Geology, Sediments, Pleistocene epoch, Bays, *Sediment deposition.

Identifiers: *Outer Continental Shelf, *Pebbles, *Cobble, *Monterey Bay(Calif).

A deposit of pebbles and cobbles was discovered in approximately 60 fm of water on the continental shelf in Monterey Bay, California. Samples were taken in the area and the extent of the deposit was determined. The material was characterized well as rounded, moderately well sorted coarse pebbles derived mainly from the granites of the Santa Lucia Formation with lesser amounts of alluvium from the Salinas Drainage Basin which flows into Monterey Bay. It was established that the deposit probably represents a marine terrace of Pleistocene Age, indicating a relative lowering of sea level of about 300 to 360 ft. This appears to be the first reported evidence of submerged marine terraces in Northern California. (Sinha-OEIS)

W77-09228

METHANE PRODUCTION AND CONSUMPTION IN ANOXIC MARINE SEDIMENTS,

Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 5C.
W77-09230**WAVE FORCES ON MODELS OF SUBMERGED OFFSHORE STRUCTURES,**

Texas A and M Univ., College Station. Dept. of Civil Engineering.

For primary bibliographic entry see Field 8B.
W77-09232**THE EVALUATION OF THE TEST PROCEDURE FOR HAZARDOUS BINARY COMBINATIONS OF MATERIALS IN MARINE TRANSPORTATION,**

Coast Guard Academy, New London, Conn.

For primary bibliographic entry see Field 5G.
W77-09236**AT SEA TESTING OF A HIGH SEA OIL RECOVERY SYSTEM,**

Ocean Systems, Inc., Reston, Va.

For primary bibliographic entry see Field 5G.
W77-09237**OIL TRANSPORTATION BY TANKERS: AN ANALYSIS OF MARINE POLLUTION AND SAFETY MEASURES.**

Office of Technology Assessment, Washington, D.C.

For primary bibliographic entry see Field 5G.
W77-09238**VULNERABILITY MODEL: A SIMULATION SYSTEM FOR ASSESSING DAMAGE RESULTING FROM MARINE SPILLS,**

Enviro Control, Inc., Rockville, Md.

For primary bibliographic entry see Field 5C.
W77-09239**TRACE METALS IN MANGROVE SEEDLINGS FROM POLLUTED AND UNPOLLUTED BAYS IN PUERTO RICO,**

Puerto Rico Nuclear Center, Mayaguez. Marine Ecology Div.

For primary bibliographic entry see Field 5A.
W77-09240**COASTAL ZONE MANAGEMENT FOCUS ON NEW ENGLAND: AN ANNOTATED SELECTED BIBLIOGRAPHY.**

Massachusetts Inst. of Tech., Cambridge.

For primary bibliographic entry see Field 6B.
W77-09241**MAY 1974 BASELINE INVESTIGATION OF DEEPWATER DUMPSITE 106.**

National Oceanic and Atmospheric Administration, Washington, D.C.; and Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5B.
W77-09243**NOAA SHIP ALBATROSS IV CRUISE 74-5 REPORT OF MAY 9-24, 1974 SURVEY OF DEEPWATER DUMPSITE 106,**

NOAA National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group.

For primary bibliographic entry see Field 5B.
W77-09244**EFFECT OF DISSOLVED OXYGEN ON REDOX POTENTIAL AND NITRATE REMOVAL IN FLOODED SWAMP.**

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.

For primary bibliographic entry see Field 5C.
W77-09286**DISTRIBUTION OF NUTRIENTS IN LOUISIANA'S COASTAL WATERS INFLUENCED BY THE MISSISSIPPI RIVER,**

Louisiana State Univ., Baton Rouge. Dept. of Marine Science; and Louisiana Wildlife and Fisheries Commission, Baton Rouge. Seafood Div.

For primary bibliographic entry see Field 5B.
W77-09323**WETLANDS-RELATED LEGISLATION IN THE UNITED STATES.**

Miami Univ., Fla. School of Law.

For primary bibliographic entry see Field 6E.
W77-09324**PROCEEDINGS OF THE EIGHTH DREDGING SEMINAR.**

Texas A and M Univ., College Station. Center for Dredging Studies.

Texas A and M University Sea Grant Program Report No. TAMU-SG-77-102, December 1976. 248 p. Also as Center for Dredging Studies CDS Report No. 195. J. B. Herbach (Ed.).

Field 2—WATER CYCLE

Group 2L—Estuaries

Descriptors: *Dredging, *Channel(Waterways), *Beach erosion, *Waste disposal, *Water quality, *Environmental effects, Spoil, Sedimentation, Texas, North Carolina, Georgia.

This volume of 10 papers constitutes the Proceedings of the Eighth Dredging Seminar held in Houston, Texas on November 8, 1975. Titles include: Physical Factors Affecting Dredged Material Islands in a Shallow Water Environment; A New Concept for Dredged Material Disposal; Dredging Operations in the Galveston District; Dredge Material Containment in Nylon Bags in the Construction of Mini-Projects for Beach Stabilization; Vessel Traffic System Houston-Galveston; The National Dredging Study; An Investigation of the Environmental Impacts Associated with the Disposal of Dredged Material at the Offshore Disposal Site, Galveston, Texas; Use of Remote Sensing in Evaluating Turbidity Plumes; Hydrologic and Sedimentologic Study of the Offshore Dredge Disposal Area, Savannah, Georgia, and Aquatic Disposal of Dredged Material, Release of Contaminants During and After Disposal. (NOAA)
W77-09325

FINE-GRAINED SEDIMENT AND INDUSTRIAL WASTE DISTRIBUTION AND DISPERSAL IN NEW BEDFORD HARBOR AND WESTERN BUZZARDS BAY, MASSACHUSETTS,
Woods Hole Oceanographic Institution, Mass. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W77-09326

THE CITIZEN'S GUIDE TO NORTH CAROLINA'S SHIFTING INLETS,
North Carolina State Univ. at Raleigh. Center for Urban Affairs and Community Services.
S. Baker.
North Carolina University Sea Grant Publication No. UNC-SG-77-08, March 1977. 32 p. Also as Center for Urban Affairs and Community Services Information Report No. 2. Chiefly aerial photos.
SG-04-6-058-44054.

Descriptors: *Aerial photography, *Inlets(Waterways), *Barrier islands, *North Carolina, Erosion, Coasts, Sedimentation, *Maps.

This pamphlet is intended for the use of citizens who do not have a scientific or engineering background. Aerial photographs are marked to show the numerous significant changes in the position and size of barrier island and inlets caused by various coastal processes. (NOAA)
W77-09327

PERFORMANCE ANALYSIS OF A TETHERED FLOAT BREAKWATER,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 8B.
W77-09328

COASTAL ENGINEERING DATA NETWORK. SECOND SEMI-ANNUAL REPORT JULY 1976 TO DECEMBER 1976,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 8B.
W77-09329

SEWAGE DISCHARGES FROM SHIPS TRANSITING COASTAL SALT WATERS,
David W. Taylor Naval Ship Research and Development Center, Annapolis, Md. Pollution Abatement Div.
For primary bibliographic entry see Field 5B.
W77-09333

STUDIES OF THE MIXING OF COASTAL WATERS IN LIVERPOOL BAY USING DISSOLVED SILICATE AS A TRACER,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
D. T. E. Hunt, and P. Foster.
Water Research, Vol. 11, No. 5, p 465-470, May 1977. 5 fig, 1 tab, 25 ref.

Descriptors: *Mixing, *Bays, *Tracers, *Model studies, Mathematical models, Coasts, Foreign countries, Foreign research, Estuaries, *Silica, Salinity, Temperature, Water temperature, Circulation, Water circulation, Surveys, On-site investigations, Rivers, Oceanography.
Identifiers: *Liverpool Bay(England), *Dissolved silica.

The essential prerequisites to be met by a natural tracer in coastal waters were stated, an assessment was made of the suitability of dissolved silicate. The application of silicate as a tracer, in conjunction with salinity and temperature, was illustrated with reference to a four-component mixing model of Liverpool Bay during January 1975. The model provides evidence for an anticlockwise residual surface circulation of the coastal waters. (Sims-ISWS)
W77-09347

CURRENTS IN JOHNSTONE STRAIT, BRITISH COLUMBIA: SUPPLEMENTAL DATA ON THE VANCOUVER ISLAND SIDE,
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.
R. E. Thomson.
Journal of the Fisheries Research Board of Canada, Vol. 34, No. 5, p 697-703, May 1977. 5 fig, 1 ref.

Descriptors: *Currents(Water), *Straits, *Current meters, *Canada, Tides, Tidal waters, Circulation, Water circulation, Estuaries, Flow, Measurement, Data processing.
Identifiers: *Johnstone Strait(British Columbia), *British Columbia, *Vancouver Island(British Columbia).

Records from a current meter recently found adrift after 3 yr were used to complete previously published cross sections of mean flow and tidal currents in Johnstone Strait. The new plots emphasize the cross-channel asymmetry of the estuarine circulation and the large phase lag of the upper layer current relative to the bottom currents for the diurnal tidal constituent. A recalculation of the net volume transport showed that its magnitude and direction remain undeterminable to the order of \pm or ± 1000 cu m/s. (Sims-ISWS)
W77-09354

DISSOLVED AMINO ACIDS IN THE EQUATORIAL PACIFIC, THE SARGASSO SEA, AND BISCAYNE BAY,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5A.
W77-09356

SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT,
Delaware Univ., Newark. Center for Remote Sensing.
For primary bibliographic entry see Field 5B.
W77-09358

ENVIRONMENTAL IMPACTS FROM OFFSHORE EXPLORATION AND PRODUCTION OF OIL AND GAS.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6G.
W77-09460

REMOTE SENSING OF SUBMERGED AQUATIC VEGETATION IN THE LOWER CHESAPEAKE BAY,
Virginia Inst., of Marine Science, Gloucester Point. Div. of Biological Oceanography.
R. J. Orth, and H. Gordon.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-18771. Price codes: A05 in paper copy, A01 in microfiche. Report NASA CR-144918, April 1975. 68 p. 29 fig., 3 tab., 14 ref. NAS1-10720.

Descriptors: *Remote sensing, *Submerged plants, Feasibility, Mapping, *Chesapeake Bay, *Aerial photography, Elasmobranchs, Marine plants.
Identifiers: Photography films, Zostera marina, Eelgrass, Cownose rays.

The feasibility of using remote sensing to: (1) delineate submerged aquatic vegetation, primarily eelgrass, in the lower Chesapeake Bay, (2) map the present distribution of submerged aquatics, (3) determine the extent of loss or recovery of eelgrass in the lower Chesapeake Bay since 1972, and (4) judge the effectiveness of various photographic films and techniques in delineating submerged vegetation, were assessed. It was concluded that remote sensing is a useful tool for studying the spatial distribution and temporal variation of submerged vegetation. There was a 36% reduction in the amount of submerged aquatics in the western part of the lower Chesapeake Bay from 1971 to 1974, with the York, Plankatank and Rappahannock rivers experiencing the greatest loss. Foraging Cownose rays were suspected as a main factor in the destruction of a number of the grass beds, while recovery of beds occurred primarily through seedling recruitment and subsequent growth. Kodak's experimental water penetration film proved more useful than black and white near infrared film. Optimal results from the new film were obtained with the camera aperture closed 1/2 stop from suggested settings, and flying at an altitude of 5000 feet at low tide in the morning when wind conditions were minimal. (Luedtke-Wisconsin).
W77-09468

CONTRIBUTIONS OF SUSPENDED AND DISSOLVED SUBSTANCES TO THE ARCTIC OCEAN DURING BREAKUP OF THE COLVILLE RIVER, ALASKA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 5C.
W77-09503

DEGRADATION OF PARATHION IN SEA-WATER,
Institut fuer Meeresforschung, Bremerhaven (West Germany).
For primary bibliographic entry see Field 5B.
W77-09506

FILAMENT FORMATION IN THE DIATOM SKELETONEMA COSTATUM,
University of Southern Mississippi, Hattiesburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-09510

THE DYNAMICS OF AN ESTUARY AS A NATURAL ECOSYSTEM.
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
For primary bibliographic entry see Field 5C.
W77-09517

USER'S MANUAL FOR THE M.L.T. TRANSIENT WATER QUALITY NETWORK

MODEL—INCLUDING NITROGEN-CYCLE DYNAMICS FOR RIVERS AND ESTUARIES, Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-09519

THE USE OF WETLANDS AS NUTRIENT REMOVAL SYSTEMS, Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5G.
W77-09520

BIODEGRADATION OF CELLULOSIC SUBSTRATES, Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 5B.
W77-09522

FEDERALISM AND THE DEVELOPMENT OF OUTER CONTINENTAL SHELF MINERAL RESOURCES, Miami Univ., Fla. School of Law.
For primary bibliographic entry see Field 6E.
W77-09531

LAND USE CONTROL IN THE COASTAL ZONE: THE DELAWARE EXAMPLE, Natural Resources Law Inst. Portland, Oreg.
For primary bibliographic entry see Field 6F.
W77-09533

REGULATING DEVELOPMENT ALONG THE CALIFORNIA COAST, California Univ., Davis. Environmental Studies Program.
For primary bibliographic entry see Field 4A.
W77-09534

THE LEGAL IMPLEMENTATION OF COASTAL ZONE MANAGEMENT: THE NORTH CAROLINA MODEL, North Carolina Univ. at Chapel Hill. School of Law.
For primary bibliographic entry see Field 6E.
W77-09547

TIDE-INDUCED RESIDUAL CURRENT-VERIFICATION OF A NUMERICAL MODEL, Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
K. T. Tee.
Journal of Physical Oceanography, Vol. 7, No. 3, p 396-402, May 1977. 8 fig, 2 tab, 10 ref.

Descriptors: *Tides, *Currents(Water), *Model studies, *On-site investigations, Tidal waters, Tidal effects, Circulation, Water circulation, Edies, Mathematical models, Data processing, Analytical techniques, Estuaries, Oceanography.
Identifiers: *Minas Bay(Nova Scotia), *Minas Channel(Nova Scotia), *Bay of Fundy(Nova Scotia), *Nova Scotia, Residual currents.

In a previous paper, tide-induced residual currents in the Minas Channel and Minas Basin were studied with a two-dimensional nonlinear numerical tidal model. It was shown that the model could reproduce well the observations obtained in 1960 and 1965. In this paper, further observations obtained in 1974 were presented. The analyzed results confirm the calculated tidal and residual currents and the mechanism that was suggested for the generation of the residual currents. Calculated and experimental results showed that the maximum M sub 2 tidal current occurs earlier in the sheltered areas. (Sims-ISWS)
W77-09559

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

MEASURES FOR REDUCING RETURN FLOWS FROM THE WELLTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT, ANNUAL REPORT FOR FY 1976, Bureau of Reclamation, Washington, D.C. Wellton-Mohawk Irrigation and Drainage District.
For primary bibliographic entry see Field 4A.
W77-09276

SYSTEM DESIGN OF A TUBULAR REVERSE OSMOSIS PLANT, California Univ., Los Angeles.
For primary bibliographic entry see Field 5F.
W77-09319

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM (FINAL ENVIRONMENTAL STATEMENT), Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-09527

3B. Water Yield Improvement

AUGMENTING SUMMER STREAMFLOW BY USE OF A SILICONE ANTITRANSPIRANT, Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences.
G. H. Belt, J. G. King, and H. F. Haupt.
Water Resources Research, Vol 13, No 2, p 267-272, April 1977. 4 fig, 1 tab, 20 ref.

Descriptors: *Streamflow, *Transpiration control, *Idaho, Emulsions, Aqueous solutions, Transpiration, Soil water, Watersheds(Basins), Regression analysis, Seasonal, Summer, Spraying.
Identifiers: *Silicone antitranspirant, Aqueous emulsion, Silicone oil, Leaf water potential, Regression equations.

A 65-acre (26.3-ha) cedar-hemlock catchment in northern Idaho was sprayed with a 5% aqueous emulsion of silicone oil to reduce transpiration. The antitranspirant, Dow Corning XE-4-3561, was applied by helicopter at the rate of 40 gal/acre (375 l/ha). From June 1 to September 15, 1974, streamflow, soil water, and leaf water potential were monitored on the 65-acre (26.3 ha) treated watershed and on an adjacent 50-acre (20.2 ha) control watershed. By using the paired watershed method with regression equations based on 6 years of pretreatment data, predicted and observed streamflow were obtained for the period June 1 to September 15. Differences between predicted and observed streamflow were compared by using the paired 't' test and were found to be significant at the 97.5% confidence level. During a 63-day period, a 12% increase in streamflow resulted from the antitranspirant application. During the same period, soil water storage was greater on the treated watershed than on the control watershed; however, the difference was not statistically significant. Seasonal leaf water potential in cedar indicated that stress was greater on the control watershed than on the treated watershed. Systematic differences in leaf potential for hemlock did not occur. (Robert-ISWS)
W77-09126

INVESTIGATION OF THE APAC WATER SEEPAGE BARRIER, Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
R. K. Frobel.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 362, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, 1975. 67 p, 19 fig, 6 tab, 20 ref, 2 append. OWRP A-059-ARIZ(1), 14-31-0001-5003.

Descriptors: *Asphalt, *Seepage control, *Barriers, *Water yield improvement, Plastics, Slope stability, Testing, *Sealants.
Identifiers: *Asphalt-plastic-asphalt-chip seepage barrier, Hydrostatic puncture resistance, Slope stability-cover aggregate, Overlap seal strength, Surface temperature, Asphalt emulsion, Asphalt residue.

The APAC (Asphalt-Plastic-Asphalt-Chip-Coated) water seepage barrier was investigated. Three testing methods were utilized. The first test evaluated the hydrostatic puncture resistance of the asphalt-polyethylene combination. The second test was that of slope stability of a 3/8 in. (9.5 mm) cover aggregate. This test was designed to determine the displacement characteristics of a cover aggregate as related to slope, temperature, and asphalt residue quantity. The third test was used to determine the overlap seal strength of three available adhesive materials. ASTM test procedures were utilized for this phase of testing. Both asphalt layers in the APAC treatment effectively increased puncture resistance over that of plain polyethylene. The 2:1 slope was stable up to a surface temperature of 122F (50C); the 3:1 and 4:1 slopes remained stable throughout testing. An increase in asphalt spread quantity reduces downslope displacement of the embedded cover aggregate. The Presstite mastic was the best suited adhesive for sealing polyethylene overlaps.
W77-09140

AEROSOL OVER THE HIGH PLAINS OF THE UNITED STATES, Washington Univ., Seattle. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 5A.
W77-09225

A SUGGESTED TECHNIQUE FOR THE ANALYSIS OF AIRBORNE CONTINUOUS ICE NUCLEUS DATA, Montana State Univ., Bozeman. Dept. of Earth Sciences.
J. A. Heimbach, Jr., A. B. Super, and J. T. McPartland.
Journal of Applied Meteorology, Vol. 16, No. 3, p 255-261, March 1977. 7 fig, 4 tab, 11 ref, 1 append.

Descriptors: *Data processing, *Analytical techniques, *Nucleation, Atmosphere, Aircraft, On-site investigations, Sampling, Silver iodide, Cloud seeding, Instrumentation, Calibrations, Measurement, Cloud physics, Meteorology.
Identifiers: *Ice nuclei, *Ice nucleus counters.

The problem of reducing data from continuously recording ice nucleus counters was addressed. The instruments characteristically have long response times which make their data difficult to interpret. A statistical theory of instrument response was developed which parameterizes the response of the instruments and reconstructs an estimate of the true count-versus-time profiles. Data from two NCAR ice nucleus counters used on separate field projects were summarized to provide example response characteristics. Field calibration techniques for these NCAR counters also were described. Although intended for use on ice nucleus counters, the interpretation techniques are applicable to other continuously recording instruments having significant response times. (Sims-ISWS)
W77-09361

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3C—Use Of Water Of Impaired Quality

3C. Use Of Water Of Impaired Quality

MEASURES FOR REDUCING RETURN FLOWS FROM THE WELLTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT, ANNUAL REPORT FOR FY 1976.

Bureau of Reclamation, Washington, D.C. Wellton-Mohawk Irrigation and Drainage District. For primary bibliographic entry see Field 4A. W77-09276

THE CHEMICAL COMPOSITION OF THE LYSIMETRIC WATER FROM SANDY PODZOLIC SOIL AND CHANGES AFFECTED BY FERTILIZERS, (IN RUSSIAN), Leningrad State Univ. (USSR).

For primary bibliographic entry see Field 2K. W77-09277

NITROGEN BALANCE IN THE SOUTHERN SAN JOAQUIN VALLEY,

California Univ., Davis. Water Science and Engineering Section. For primary bibliographic entry see Field 5B. W77-09284

EFFECTS OF DROUGHT AND SALINITY ON SOME GROWTH CONTRIBUTING PARAMETERS IN WHEAT AND BARLEY,

Assiut Univ. (Egypt). Dept. of Botany. H. M. El-Sharkawi, and F. M. Salama. Plant and Soil, Vol. 46, p. 423-433, 1977. 4 fig, 2 tab, 17 ref.

Descriptors: *Drought resistance, *Salt tolerance, *Crop response, *Wheat, *Barley, Planting management, *Plant growth, Transpiration control, Soil water, Plant physiology, Plant morphology, Chlorophyll, *Salinity, On-site investigations, Moisture stress, Osmosis, Water balance, Growth rates. Identifiers: *Egypt, Osmotic potential, Matric potential.

Wheat and barley cultivars grown at the Assiut Desert Experiment Station in Egypt were studied to determine the effects of salinity and reduced soil water potential on transpiration efficiency (dry matter/transpiration ratio), leaf/root ratio, chlorophyll content and stability to heat, and anatomical modifications. Results indicated greater transpiration efficiency in Mexican 'super-x' wheat than in the Egyptian 'Giza-155' cultivars under reduced soil water matric or osmotic potentials. Reduced matric potential usually caused an increased dry matter/transpiration ratio, and salinity had a suppressing effect on most cultivars tested. Super-x chlorophyll content increased and chlorophyll heat stability decreased leaf/root ratio. Among barley cultivars, transpiration efficiency was higher in Giza-117 than in Borg El-Arab under reduced soil water osmotic potential. Lower leaf/root ratios in the Giza-117 make that cultivar preferable for saline soils, while Borg El-Arab is favored for drought resistance. (Jahns-Arizona) W77-09312

WATER RECLAMATION: TECHNOLOGY AND PUBLIC ACCEPTANCE,

Stone (Ralph) and Co., Inc., Los Angeles, Calif. For primary bibliographic entry see Field 5D. W77-09317

3D. Conservation In Domestic and Municipal Use

MODELING URBAN RUNOFF FROM A PLANNED COMMUNITY,

Espey, Huston and Associates, Inc., Austin, Tex. For primary bibliographic entry see Field 5B. W77-09219

W77-09190

APPLICATION OF STORM AND SWMM FOR ASSESSMENT OF URBAN DRAINAGE ALTER-NATIVES IN CANADA, MacLaren (James F.) Ltd., Willowdale (Ontario).

For primary bibliographic entry see Field 5B. W77-09199

MALVERN URBAN TEST CATCHMENT, VOLUME I, Canada Centre for Inland Water, Burlington (Ontario).

For primary bibliographic entry see Field 4D. W77-09217

URBAN WATER PLANNING, A BIBLIOGRAPHY, VOLUME 2,

Office of Water Research and Technology, Washington, D.C. For primary bibliographic entry see Field 6B. W77-09264

URBAN WATER RUNOFF AND WATER QUALITY CONTROL,

Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center. For primary bibliographic entry see Field 5B. W77-09267

3E. Conservation In Industry

RADIONUCLIDE REMOVAL BY THE PH ADJUSTMENT OF PHOSPHATE MILL EFFLUENT WATER,

Eastern Environmental Radiation Facility, Montgomery, Ala. For primary bibliographic entry see Field 5D. W77-09180

AEROBIC DIGESTION OF ORGANIC SLUDGES CONTAINING INORGANIC PHOSPHORUS PRECIPITATES, VOLUME II, SLUDGES PRECIPITATED BY LIME ADDITIONS TO RAW SEWAGE,

Toronto Univ. (Ontario). Dept. of Civil Engineering; and Toronto Univ. (Ontario). Inst. for Environmental Studies and Engineering. For primary bibliographic entry see Field 5D. W77-09216

MANUFACTURING WATER USE SURVEY, 1972 - A SUMMARY OF RESULTS,

Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch. D. M. Tate. Social Science Series No 17, 1977. 14 p, 9 tab.

Descriptors: *Water utilization, *Water consumption, Industrial water, Industrial plants, Surveys, Data collections, Intakes, Recirculated water, Discharge(Water), Sewers, Surface waters, *Canada, Water conservation. Identifiers: Provincial consumption rates.

Results are summarized of the Manufacturing Section of the 1972 Survey of Industrial Water Use, the first of its kind to be undertaken nationally in Canada. Figures and discussion are presented on various parameters of water used by industry, such as intake, recirculation and discharge. Similar figures are given for water used by industry within each province. This survey is the first of a continuing series of surveys to be undertaken at five-year intervals, with the next survey beginning early in 1977. These statistics will provide a valuable input to water management, planning and related activities such as water needs forecasting. (WATDOC) W77-09219

WATER RECLAMATION: TECHNOLOGY AND PUBLIC ACCEPTANCE, Stone (Ralph) and Co., Inc., Los Angeles, Calif. For primary bibliographic entry see Field 5D. W77-09317

CONVERSION OF CATTLE MANURE INTO USEFUL PRODUCTS,

California Univ., Los Angeles. School of Engineering and Applied Science. For primary bibliographic entry see Field 5D. W77-09395

ACTIVATED CARBONS FOR EFFLUENT AND WATER TREATMENT,

For primary bibliographic entry see Field 5D. W77-09409

TREATING WASTE WATER FROM BECKMAN PREP. OF LACTAM-BY TWO STAGE CONC. EXTN. OF RESIDUAL LACTAM, RESIDUE COMBUSTION, SULFUR DIOXIDE RECOVERY AND CONVERSION TO SULFURIC ACID FOR RECYCLING.

For primary bibliographic entry see Field 5D. W77-09410

SOME CONSIDERATIONS ON THE RECOVERY AND DISPOSAL OF PHOTOLAB WASTE,

For primary bibliographic entry see Field 5D. W77-09411

MEMBRANE ULTRAFILTRATION FOR TREATMENT AND WATER REUSE OF TNT-MANUFACTURING WASTES,

Kentucky Univ., Lexington. Dept. of Chemical Engineering. For primary bibliographic entry see Field 5D. W77-09412

TREATING DISTILLERY EFFLUENT BY RECOVERING TARTAR AND ORGANIC MATTER-WITHOUT INCREASING THE VOL. OF EFFLUENT DURING PURIFICATION.

For primary bibliographic entry see Field 5D. W77-09414

A THERMAL CONTROLLER FOR THE SHORT COD DETERMINATION,

Agricultural Research and Education Center, Lake Alfred, Fla. For primary bibliographic entry see Field 5A. W77-09415

ANAEROBIC DIGESTION OF RUM STILLAGE,

National Research Council of Canada, (Ontario). Div. of Biological Sciences. For primary bibliographic entry see Field 5D. W77-09416

'NOT ONE DROP OF EFFLUENT'-HYDROCHLORIC ACID RECOVERY FROM SPENT PICKLE LIQUOR.

For primary bibliographic entry see Field 5D. W77-09417

ALTERNATIVE METHODS OF PHENOL WASTEWATER CONTROL,

Envirex Inc., Waukesha, Wis. For primary bibliographic entry see Field 5D. W77-09419

NEW TRENDS IN SOUR WATER STRIPPING,

Shell Canada Ltd., Toronto (Ontario). For primary bibliographic entry see Field 5D. W77-09421

REMOVING HEAVY METALS IN TEXTILE WASTE.
Permutit Co., Paramus, N.J.
For primary bibliographic entry see Field 5D.
W77-09423

INDUSTRIAL WATER USE.
Public Health Service, Washington, D.C. Div. of Water Supply and Pollution Control.
For primary bibliographic entry see Field 6D.
W77-09449

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOLUME 1. EXECUTIVE SUMMARY.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09451

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PET. REFINING IND. VOL. 2, PTS 1 AND 2. IND. DESCRIPTION AND TECH. ANALYSIS.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09452

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOL. 3, PT. 3. ECONOMIC IMPACT ANALYSIS.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09453

POTENTIAL ENVIRONMENTAL IMPACTS FROM THE PRODUCTION OF SYNTHETIC FUELS FROM COAL.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 5B.
W77-09458

SITING OF MAJOR ENERGY FACILITIES.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6G.
W77-09459

SURVEY OF INDUSTRIAL PROCESSING DATA. TASK I-HEXACHLOROBENZENE AND HEXACHLOROBUTADIENE POLLUTION FROM CHLOROCARBON PROCESSING.
Midwest Research Inst., Kansas City, Mo.
For primary bibliographic entry see Field 5B.
W77-09475

METHODOLOGY FOR ASSESSING ENVIRONMENTAL IMPLICATIONS AND TECHNOLOGIES: NONFERROUS METALS INDUSTRIES.
Battelle-Columbus Labs., Columbus, Ohio.
For primary bibliographic entry see Field 5G.
W77-09479

3F. Conservation In Agriculture

PREDICTING ATTAINABLE IRRIGATION EFFICIENCIES IN THE UPPER SNAKE RIVER REGION.
Idaho Univ., Moscow. Dept. of Civil Engineering.
B. A. Claiborn.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 361.
Price codes: A10 in paper copy, A01 in microfiche.
M.S. Thesis, May 1975. 197 p, 10 fig, 18 tab, 45 ref, 7 append. Idaho Water Resources Research Institute, Moscow. OWRT A-040-IDA(1), 14-31-0001-5012.

Descriptors: *Irrigation practices, Irrigation districts, Consumptive use, *Irrigation efficiency, *Idaho, *Forecasting.
Identifiers: Reasonably attainable efficiency, *Upper Snake River Region (Idaho).

1974 irrigation season water use was studied on six independent irrigation districts in the Upper Snake River Region of southern Idaho. Present efficiencies and reasonably attainable efficiencies were evaluated. River diversion data, conveyance system seepage loss data, crop distribution and return flow data were compiled. Deep percolation losses and irrigation efficiencies were derived using an inflow-outflow water balance analysis. Farm efficiencies ranged from 11 to 62 percent, compared to 10 to 42 percent project efficiency. Reasonably attainable project irrigation efficiencies were projected to range from 35 to 51 percent. Low present farm irrigation efficiencies were attributed to over irrigation caused by long field runs combined with high intake rate soils. Lining main canal systems to reduce seepage would not significantly increase project irrigation efficiencies. Large decreases in river diversion could be obtained by increasing farm irrigation efficiencies.
W77-09137

EFFECT OF SEVERAL CULTURAL PRACTICES ON THE ESTABLISHMENT OF ALFALFA (MEDICAGO SATIVA L.).
Arizona Univ., Tucson. Dept. of Agronomy and Plant Genetics.
A. Meddeb.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 506.
Price codes: A04 in paper copy, A01 in microfiche.
Master of Science Thesis, 1975. 49 p, 8 fig, 8 tab, 34 ref. OWRT A-034-ARIZ(2), 14-31-0001-5003.

Descriptors: *Alfalfa, *Cultivation, Seedlings, Seeds, Seed treatment, *Planting management, Oats, Greenhouses, *Soil treatment, Crop production.
Identifiers: *Sulfuric acid, *Phosphoric acid, *Soil crusting, *Seedling emergence.

Alfalfa (Medicago sativa var. Hayden) was planted in a greenhouse and field experiment to determine the effect of surface applied phosphoric acid, seeding method, seeding rate, and delayed overseeding with oats (Avena sativa L.) on seedling emergence and yield. The research was conducted to identify improved methods of alfalfa stand establishment. Under greenhouse conditions significantly more seedlings emerged when seed were planted at 1.25 as compared to 2.50 cm depth. When 1,300 l/ha of 12% phosphoric acid were applied to the soil surface after planting, crusting was reduced and significantly more seedlings emerged from soil in the treated pots. In the field experiment weight of seedlings from plots treated with phosphoric acid was greater than from plots receiving soil incorporated phosphorus. Rains that occurred after planting the field experiment prevented the formation of serious soil crusts. Surface applied phosphoric acid did not increase the number of emerged seedlings under these conditions. Seeding counts were made 10 days after planting. When seed were broadcast and the soil was cultipacked and treated with acid, significantly more seedlings were produced. For broadcast plantings, seedlings were significantly larger when taken from the cultipacked furrow than from the ridge. Forage yields from the first harvest did not differ significantly for the 11.2 and 22.4 kg/ha broadcast seeding rates, but were significantly less for the lower seeding rate when seed were drilled. Delayed overseeding with oats did not significantly increase forage yield.
W77-09144

SIMULATION OF AGRICULTURAL RUNOFF.
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5B.
W77-09173

INFLUENCE OF CROP MANAGEMENT PRACTICES ON NUTRIENT MOVEMENT BELOW THE ROOT ZONE IN NEBRASKA SOILS.
Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 2G.
W77-09279

LEAD EFFECTS ON SEVERAL ENZYMES AND NITROGENOUS COMPOUNDS IN SOYBEAN LEAF.
Taiwan Provincial Chung-Hsing Univ., Taichung.
For primary bibliographic entry see Field 5C.
W77-09280

THE ROLE OF SYSTEMS ANALYSIS IN THE USE OF AGRICULTURAL WASTES.
Manitoba Univ., Winnipeg Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W77-09282

RESIDUES OF DICHLOBENIL IN IRRIGATION WATER.
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Irrigation Research Lab.
For primary bibliographic entry see Field 5B.
W77-09287

GENOTYPIC RESPONSES IN SORGHUM TO DROUGHT STRESS. III. FREE PROLINE ACCUMULATION AND DROUGHT RESISTANCE.
Agricultural Research Service, Temple, Tex. Blackland Conservation Research Center.
A. Blum, and A. Ebercon.
Crop Science, Vol. 16, p 428-431, May-June 1976. 1 fig, 3 tab, 25 ref.

Descriptors: *Crop response, *Grain sorghum, *Moisture stress, *Drought resistance, *Amino acids, Plant growth, *Drought tolerance, Ammonia, Respiration, Plant physiology, Genetics, Dry farming.
Identifiers: *Genotype, *Israel, Leaf water potential, Desiccation tolerance, Recovery resistance.

Grain sorghum (Sorghum bicolor (L.) Moench) cultivars grown in the field under dryland conditions at Bet Dagan, Israel, and in a growth chamber were studied to determine the association between free proline amino acid accumulation in water-stressed leaves and drought resistance. Eight cultivars were grown in a growth chamber under a drying cycle (to a leaf water potential of -18 to -21 bars) and subsequent recovery phase. Desiccation tolerance and recovery upon rehydration ('recovery resistance') were studied. Rapid proline accumulation began in leaves of all cultivars when leaf water potential dropped to -14 to -16 bars. Free ammonia concentration did not change significantly during the drying cycle but increased rapidly within 24 hours after rewetting while free proline content decreased. Cultivars differed significantly in maximum free proline accumulation and post-stress ammonia concentration, dark respiration rate and recovery rating. Correlations indicated desiccation tolerance was unrelated to the attributes measured. Free proline accumulation during water stress was correlated with the post-stress recovery rating, free ammonia concentration and dark respiration rate. Results indicate proline accumulation is associated positively with recovery resistance, possibly as a source of respiratory energy in the recovering plant. (Jahns-Arizona)
W77-09297

SOIL WATER-ROOT RELATIONS IN WHEAT: WATER EXTRACTION RATE OF WHEAT ROOTS THAT DEVELOPED UNDER DRY AND MOIST CONDITIONS.
Leeds Univ. (England). Dept. of Plant Sciences.
For primary bibliographic entry see Field 2I.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

W77-09300

LEAF GROWTH IN RELATION TO ATP LEVELS IN WATER STRESSED CORN PLANTS, Macquarie Univ., North Ryde (Australia). School of Biological Sciences.
E. W. R. Barlow, T. M. Ching, and L. Boersma.
Crop Science, Vol. 16, p 405-407, May-June 1976. 2 fig, 19 ref.

Descriptors: *Plant growth, *Moisture stress, *Corn(Fields), *Leaves, *Plant growth substances, Amino acids, Turgidity, Plant physiology, Metabolism.
Identifiers: *Adenosine triphosphate, Cell water potential, Turgor potential, Leaf elongation, Leaf water potential.

Early physical and metabolic changes in water stressed corn (*Zea mays* L. 'Pride 5') plants grown from seed in soil slabs were studied by monitoring for 48 hours the cell water potential, turgor potential, leaf elongation, adenylate energy charge, free amino acids and ATP concentrations of elongating leaves. Reduced cell turgor and leaf elongation rate induced by gradually decreasing the leaf water potential from -2.6 to -18 bars under continuous light caused a 40% drop in the ATP concentration of the elongating zone within 3 hours and a 25% drop in adenylate energy charge within 12 hours. Free amino acid concentration increased about 20% during the first 6 hours and over 250% in the full 48 hours. Possible causes and significance of a decrease in ATP concentrations are discussed. The response may indicate that ATP acts as a modulator of metabolic activity within the cell during brief periods of water stress cycles which often occur with field grown plants. ATP's regulation of biosynthesis at the enzymatic level may allow the plant to survive a stress cycle without undergoing an ontogenic shift. (Jahns-Arizona)
W77-09301

EFFECT OF WATER STRESS DURING DIFFERENT STAGES OF GROWTH OF SOYBEAN, Pahlavi Univ., Shiraz (Iran).
For primary bibliographic entry see Field 2I.
W77-09302

SORGHUM GENOTYPE VARIATION IN STOMATAL SENSITIVITY TO LEAF WATER DEFICIT, Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 2I.
W77-09303

STAND ESTABLISHMENT OF WHEAT LINES UNDER DIFFERENT LEVELS OF WATER POTENTIAL, Kabul Univ. (Afghanistan). Faculty of Agriculture.
A. Gul, and R. E. Allan.
Crop Science, Vol. 16, p. 611-615, September-October 1976. 1 fig, 4 tab, 11 ref.

Descriptors: *Plant growth, *Germination, *Wheat, *Soil water, *Soil-water-plant relationships, Planting management, Laboratory tests, On-site tests, Seeds, Root development, Correlation analysis.
Identifiers: *Soil water potential, *Seedling emergence, Emergence rate index(ERI), Coleoptile, Total stand(TS).

Four soil water levels were used in a study of seedling emergence and growth of 93 wheat (*Triticum aestivum* L. em Thell) lines and four check cultivars. The purpose was to determine if selected groups of wheat lines differ in ability to germinate and emerge under various soil water potentials and to consider the feasibility of laboratory tests to screen germplasm for germination and

emergence capability at low water potential. Wheat lines used were developed by recurrent selection for improved seedling vigor; studies were conducted at four soil water levels in laboratory tests and at different planting depths and locations in three field tests. Soil water potential strongly influenced emergence rate index (ERI), although lines differed markedly in emergence characteristics. The ERI was high for a number of lines in all four water potentials (-2.2, -6.0, -10.2 and -14.4 bars) and in field tests, indicating almost a doubling of emergence time for each -4 bars decrease in water potential. Total stand, coleoptile length, seedling weight were generally related in field tests, and root weights of 9 promising lines were correlated at the lowest water potential in laboratory tests. (Jahns-Arizona)
W77-09304

INFLUENCE OF INDETERMINATE GROWTH HABIT ON YIELD AND IRRIGATION WATER-USE EFFICIENCY IN UPLAND COTTON, Agricultural Research Service, Lubbock, Tex. Oklahoma-Texas Area.
J. E. Quisenberry, and B. Roark.
Crop Science, Vol. 16 p 762-765, November-December 1976. 3 tab, 17 ref.

Descriptors: *Plant growth, *Crop production, *Cotton, *Irrigation efficiency, *Soil-water-plant relationships, Irrigation effects, Texas, Irrigation practices, Semiarid climates, Planting management, Dry farming, Soil moisture, Crop response, Water requirement.
Identifiers: *Indeterminate growth, Lint yield.

Studies of 12 cultivars of upland cotton (*Gossypium hirsutum* L.) grown at three moisture levels at Lubbock, Texas were conducted to evaluate the relationships between the degree of indeterminate growth habit, irrigation water-use efficiency and lint yield in upland cotton. Moisture regimes were dryland, preplant irrigation and full irrigation. Cultivars were placed according to their growth habit in four groups designated as High Plains-determinate, High Plains-moderately determinate, High Plains-indeterminate and non High Plains-indeterminate. Lint yields were higher in the indeterminate groups at all moisture levels; irrigation water-use efficiency was higher at the indeterminate moisture level (preplant irrigation). Indeterminate cultivars grown at the intermediate moisture level had a higher irrigation water-use efficiency than did determinate cultivars. Efficiency was greater for determinate cultivars at the higher moisture level. Correlation analyses suggested that a cultivar with a relatively indeterminate growth habit is better adapted to a nonirrigated semiarid environment. (Jahns-Arizona)
W77-09306

EFFECTS OF CONDENSED PHOSPHATES ON PLANT GROWTH AND PHOSPHORUS UPTAKE, Edinburgh Univ. (Scotland). School of Agriculture.
F. M. El-Reweiny, K. Simpson, P. Crooks, and S. McIntosh.
Plant and Soil, Vol. 44, p. 1-14, 1976. 4 fig, 3 tab, 15 ref.

Descriptors: *Plant growth, *Phosphates, *Nutrient removal, Hydrolysis, Acidic soils, Alkaline soils, Soil dynamics, Grasses, Phosphorous, Soil-water-plant relationships, *Absorption.
Identifiers: *Phosphorus uptake, *Orthophosphates, *Ryegrass, Citric acid.

Four condensed phosphate, including ring- and chain-structured molecules, were equivalent to orthophosphate in terms of phosphorus uptake and dry matter yield of ryegrass grown in two soils in pots. Equivalence held for 6 samplings during two seasons and for aggregate yield. All sources had significant yield and P-uptake increases over

control on both soils. Applied P uptake increased greatly with higher N rates, but there was no differential effect with different P sources, nor any interaction between source and application rate. There was no leaching of P, indicating rapid phosphate adsorption by soils. Hydrolysis of condensed phosphates was fairly rapid in a neutral pH soil and slower in an acid soil. A good correlation was observed between P uptake by ryegrass and the additional orthophosphate released by an acid hydrolysis of soil extracts. Citric acid extracts made at intervals may indicate the rate of condensed phosphate hydrolysis. Equality of performance by condensed phosphates and orthophosphate was probably due to rapid hydrolysis of the condensed phosphates. (Jahns-Arizona)
W77-09307

EFFECTS OF DROUGHT AND SALINITY ON SOME GROWTH CONTRIBUTING PARAMETERS IN WHEAT AND BARLEY, Assiut Univ. (Egypt). Dept. of Botany.
For primary bibliographic entry see Field 3C.
W77-09312

THE EFFECTS OF DRYING OF THE TOPSOIL AND OF MICRONUTRIENTS IN THE SUBSOIL ON MICRONUTRIENT UPTAKE BY AN INTERMITTENTLY DEFOILATED RYEGRASS, Adelaide Univ. (Australia). Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W77-09314

ESTIMATED EVAPOTRANSPIRATION AND IRRIGATION REQUIREMENTS FOR CITRUS, Louisiana Univ., Gainesville. Inst. of Food and Agricultural Science.
For primary bibliographic entry see Field 2D.
W77-09406

FATE OF FERTILIZER NITROGEN IN A FLOODED RICE SOIL, Louisiana State Univ., Baton Rouge. Lab. of Flooded Soils and Sediments; and Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09438

PHOSPHORUS FERTILIZATION WITH DRIP IRRIGATION, California Univ., Davis. Dept. of Land, Air, and Water Resources.
R. S. Rauschkolb, D. E. Rolston, R. J. Miller, A. B. Carlton, and R. G. Burau.
Soil Science Society of America Journal, Vol 40, No 1, p 68-72, January-February 1976. 3 fig, 3 tab, 10 ref.

Descriptors: *Phosphorus, *Nutrients, *Fertilization, *Fertilizers, Irrigation, Irrigation systems, Irrigation effects, Irrigation operation and maintenance, Rates of application, Plant physiology.
Identifiers: Phosphorus movement, *Drip irrigation.

Application of plant nutrients with drip irrigation systems is desirable for labor and energy savings and flexibility in timing nutrient applications. Evaluations of P movement in the soil and uptake by tomatoes were made when orthophosphate and glycerol-phosphate were applied through a drip irrigation system and in comparison with 26 kg of P/ha banded below the seed at planting. A significantly higher P content was measured in seedling leaves when 26 kg of P/ha was applied by drip irrigation than when the same rate was banded. No differences in P content of whole tops of seedlings were measured at equal rates of inorganic or organic P applied through the drip system. There was a significant linear response of P uptake to P rate. With drip irrigation, orthophosphate moved a much greater distance into the soil than had been

previously observed for comparable application rates per hectare. Glycerophosphate moved 5 to 10 cm farther through the soil at application rates of 6.5 and 13 kg of P/ha than did orthophosphate. (Skogerboe-Colorado State)
W77-09443

CORN CULTIVATION IN THE SAND OF THE BUKHARA OASIS, (IN RUSSIAN), Bukharskii Gosudarstvennyi Pedagogicheskii Institut (USSR). I. K. Nazarov. Probl Osvoeniya Pustyn'. 6, p 71-73, 1973.

Descriptors: *Corn(Field), *Fertilization, *Nitrogen, Irrigation, Land reclamation, *Cultivation, *Sands, Arid lands.
Identifiers: *USSR(Bukhara Oasis).

Reclamation of sands (2 m in depth) involves complete leveling of the surface. The application of 200 kg of N and systematic irrigation of the area resulted in an abundant harvest of 'Krasnodarskaya 49' maize.—Copyright 1975, Biological Abstracts, Inc.
W77-09496

THE ROLE OF IRRIGATION IN FOOD PRODUCTION, Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div. J. Doorenbos. Agriculture and Environment, Vol 2, No 1, p 39-54, June 1975. 3 tab, 15 ref.

Descriptors: *Food abundance, *Irrigation effects, *Agriculture, *Climatic data, *Irrigation efficiency, Food and cover crops, Irrigation systems, Water distribution(Applied), Irrigation practices, Agricultural engineering, Farm management, Water resources, Ecology, Costs, Cost-benefit analysis.
Identifiers: *Climate control.

The world food situation is deteriorating at a slow but steady pace. Figures and projections indicate that while the food supply improvement rate is rising, the food demand is rising even faster. This article suggests a plan for fighting the growing food gap on a worldwide basis. Fluctuations in food production need to be minimized, and because the climate is responsible, more research must be done into the possibility of climate control. Land needs to be used more intensively. The quickest way to raise production per acre is through increased irrigation. Investment in irrigation and drainage work must therefore be regarded as basic to agricultural development and, consequently, to long term goals for social and economic development. Farmers must be given the ability to make do with less water and to use it more wisely. The major problem with this approach is that materials are expensive, and the cost presently seems prohibitive for an expansion worldwide in irrigation. Also, wherever and whenever possible, the total approach to an area's ecology must be considered before land is developed. Finally, a comprehensive series of options ranked according to priority must be created so that future development will be as orderly as possible. (Frank Florida)
W77-09535

SECONDARY AUTUMN SHOOT FORMATION IN SPRING WHEAT: I. THE ROLE OF DROUGHT DAMAGE AND DEVELOPMENTAL STAGES, (IN RUSSIAN), Akademiya Nauk SSSR, Novosibirsk. Inst. of Soil Sciences and Agrochemistry. For primary bibliographic entry see Field 2I.
W77-09545

PERMIT PROGRAM REGULATIONS FOR AGRICULTURAL ACTIVITIES, (NPDES), (PROPOSED), Environmental Protection Agency, Washington, D. C. For primary bibliographic entry see Field 6E.
W77-09560

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

RECORDING RIVER AND RESERVOIR WATER DEPTH, Moore, Gardner and Associates, Inc., Asheboro, N. C. For primary bibliographic entry see Field 7B.
W77-09106

THEORETICAL PROBABILITY DISTRIBUTION OF CRITICAL HYDROLOGIC EVENTS BY THE PARTIAL-DURATION SERIES METHOD, Rome Univ. (Italy). Istituto di Costruzioni Idrauliche. For primary bibliographic entry see Field 2B.
W77-09109

CRITERION TO CHOOSE STEP LENGTH FOR SOME NUMERICAL METHODS USED IN HYDROLOGY, New Mexico Inst. of Mining and Technology, Socorro. For primary bibliographic entry see Field 2E.
W77-09110

OPTIMAL FILTERING TECHNIQUES FOR HYDROLOGICAL FORECASTING, Public Power Corp., Athens (Greece). For primary bibliographic entry see Field 2E.
W77-09111

THE CALIBRATION OF SHARP CRESTED WEIRS BY THE PONDAGE DRAWDOWN METHOD, Sheffield Univ. (England). Dept. of Civil and Structural Engineering. For primary bibliographic entry see Field 8C.
W77-09113

THE EFFECT OF RAINFALL INTENSITY ON STORM FLOW AND PEAK DISCHARGE FROM FOREST LAND, Georgia Univ., Athens. School of Forest Resources. For primary bibliographic entry see Field 2B.
W77-09125

AUGMENTING SUMMER STREAMFLOW BY USE OF A SILICONE ANTITRANSPIRANT, Idaho Univ., Moscow. Coll. of Forestry, Wildlife and Range Sciences. For primary bibliographic entry see Field 3B.
W77-09126

AN OPERATIONAL APPROACH TO PRESERVING SKEW IN HYDROLOGIC MODELS OF LONG-TERM PERSISTENCE, Washington Univ., Seattle. Dept. of Civil Engineering. For primary bibliographic entry see Field 2A.
W77-09127

RURAL WATER DISTRICTS IN KANSAS. Kansas Water Resources Board, Topeka. For primary bibliographic entry see Field 6D.
W77-09135

PREDICTING ATTAINABLE IRRIGATION EFFICIENCIES IN THE UPPER SNAKE RIVER REGION, Idaho Univ., Moscow. Dept. of Civil Engineering. For primary bibliographic entry see Field 3F.
W77-09137

INVESTIGATION OF THE APAC WATER SEEPAGE BARRIER, Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics. For primary bibliographic entry see Field 3B.
W77-09140

THE UTILITY OF COMPUTERS IN LANDSCAPE PLANNING, THE SELECTION AND APPLICATION OF A COMPUTER MAPPING AND ASSESSMENT SYSTEM FOR THE METROPOLITAN LANDSCAPE MODEL (METLAND), Massachusetts Univ., Amherst. Dept. of Landscape Architecture and Regional Planning. For primary bibliographic entry see Field 6A.
W77-09151

MODELING HYDROLOGIC LAND-USE INTERACTIONS IN FLORIDA, Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering. For primary bibliographic entry see Field 5B.
W77-09189

MODELING URBAN RUNOFF FROM A PLANNED COMMUNITY, Espey, Huston and Associates, Inc., Austin, Tex. For primary bibliographic entry see Field 5B.
W77-09190

ENVIRONMENTAL, FISCAL AND SOCIO-ECONOMIC IMPACT OF LAND USE POLICIES: TOWARD AN INTERACTIVE ANALYSIS, Meta Systems Inc., Cambridge, Mass. For primary bibliographic entry see Field 6B.
W77-09196

APPLICATION OF STORM AND SWMM FOR ASSESSMENT OF URBAN DRAINAGE ALTERNATIVES IN CANADA, MacLaren (James F.) Ltd., Willowdale (Ontario). For primary bibliographic entry see Field 5B.
W77-09199

SIMULATION AND MATHEMATICAL MODELING OF WATER SUPPLY SYSTEMS - STATE-OF-THE-ART, Michigan Univ., Ann Arbor. School of Public Health. R. A. Deininger. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 634-638, July 1976. 106 ref.

Descriptors: *Simulation analysis, *Water supply, *Mathematical models, Demand, Forecasting, Design, Operations, Regions, Networks, Treatment facilities, Water distribution(Applied), Water quality, Systems analysis.

Mathematical modeling and simulation techniques have been used extensively in many parts of the overall water supply system ranging from the actual abstraction of water from ground and surface water sources to the primary collection and con-

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

veyance system, the water treatment plant, and the final distribution system. This article presents a brief survey of the following areas: population projections and forecasts of demand; design and operation of well fields; regional water supply networks; design and operation of treatment plants; and design and operation of the distribution system. Considered is the development of a drinking water quality index. It is concluded that the use of mathematical models and simulation techniques, including linear and dynamic programming, aids in the analysis of water supply systems in four major ways: (1) allows more alternatives at every level of decision making; (2) allows better testing of assumptions and estimation of the influence of uncertainties; (3) provides for making explicit judgements which are clearly laid out; and (4) serves as a communication tool for all professionals involved in water supply systems planning. (See also W77-09154) (Bell-Cornell) W77-09200

HYDROLOGIC IMPACT STUDIES OF ALTERNATIVES TO MEET WATER NEEDS IN SOUTH CENTRAL PENNSYLVANIA.
Resource Analysis Inc., Cambridge, Mass.
For primary bibliographic entry see Field 6D.
W77-09203

THE OPERATIONAL WATER QUANTITY MODEL.
Central and Southern Florida Flood Control District, West Palm Beach. Resource Planning Dept. A. N. Shahane, P. Berger, and R. L. Hamrick.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 657-663, July 1976. 8 fig, 4 tab, 10 ref.

Descriptors: Hydrology, *Simulation analysis, *Rainfall, *Watersheds(Basins), *Streamflow, *Methodology, Estimating, River basins, Water conveyance, Lakes, Canals, Water levels, Water loss, Water storage, Evapotranspiration, Computer programs, Hydraulics, Equations, Mathematical models, Systems analysis.
Identifiers: *Water quantity, *Routing model, Kissimmee River basin(Fla).

A recently completed operational water quantity model based on hydrologic-hydraulic simulations is presented. Using the rainfall input, initial state conditions and basin parameters, the model estimates, among many hydrologic entities, the streamflows contributed by the watersheds. An iterative type routing model is then developed to distribute the simulated streamflows through the primary conveyance systems of lakes, canals, and channelized river controlled by the gate operations at the controlling structures. The designed methodology is demonstrated for the Kissimmee River basin in Florida for the year 1970 by considering 21 canals, 14 lakes, and 14 controlling structures. The outcome of the model relates to simulated lake stages, water levels at tailwater and headwater sides of the controlling structures and simulated discharges through controlling structures every 3 hours for the full year of 1970. The comparison of simulated values with the corresponding historical data indicates clearly the 'working' of all the individual pieces of the operational water quantity model, although a few critical links are currently being refined to obtain better simulated lake stages. (See also W77-09154) (Bell-Cornell) W77-09204

THE COST OF WATER SUPPLY UTILITY MANAGEMENT.
Municipal Environmental Research Lab., Cincinnati, Ohio. Water Supply Research Div.
For primary bibliographic entry see Field 6B.
W77-09209

DEVELOPMENT OF THE SPRING CREEK DATA ACQUISITION SYSTEM.
Montana State Univ., Bozeman. Dept. of Electrical Engineering.
For primary bibliographic entry see Field 7A.
W77-09258

PREDICTING CHANGES IN LAND-USE PATTERNS RESULTING FROM WATER RESOURCE INVESTMENT USING A NON STATIONARY MARKOV PROCESS.
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W77-09268

LAND MANAGEMENT IN THE LAKE ONTARIO BASIN.
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 6B.
W77-09275

MEASURES FOR REDUCING RETURN FLOWS FROM THE WELTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT, ANNUAL REPORT FOR FY 1976.
Bureau of Reclamation, Washington, D.C. Wellton-Mohawk Irrigation and Drainage District.
Prepared by the Technical Field Committee, October 1976. 87 p, 3 fig, 5 tab, 2 append.

Descriptors: *Return flow, Drainage districts, Irrigation districts, Irrigation efficiency, Irrigable land, Irrigation programs, Irrigation engineering, Project planning, Southwest U. S., Distribution systems, Drainage engineering, Salinity, Desalination plants, Management, Projections.
Identifiers: Wellton-Mohawk Irrigation and Drainage District.

The Special Report, September 1974, Measures for Reducing Return Flows from the Wellton-Mohawk Irrigation and Drainage District described a program to improve irrigation efficiencies in the Wellton-Mohawk Irrigation and Drainage District. By reducing the volume of the return flows from the District, the size of the desalting plant authorized under Public Law 93-320 can also be reduced. The objective is to reduce return flows from the original level of about 215,000 acre-feet per year to the program level 3 of about 136,000 acre-feet per year. This report describes the progress for fiscal year 1976; the first annual report covering activities for fiscal year 1975 was published in October 1975. The program involves reduction of the irrigable acreage in the District from 75,000 to 65,000 acres and structural and management improvements on the farms in the District. Onfarm irrigation efficiencies are to be improved from the present level of about 56 percent to 64 percent with an ultimately practicable goal of 72 percent. The program includes technical assistance to farmers, research and demonstration of advance agronomic practices, and an intensive education and information effort to advance community acceptance of the program. (Bur Reclam) W77-09276

WATER RESOURCE AND LAND USE PROBLEMS IN WESTERN AUSTRALIA.
Perth Public Works Dept. (Australia). Planning Design and Investigation Branch.
For primary bibliographic entry see Field 4C.
W77-09296

THE CENTRAL ARIZONA PROJECT: AN INQUIRY INTO ITS POTENTIAL IMPACTS.
Arizona Univ., Tucson. Coll. of Business and Public Administration.
For primary bibliographic entry see Field 6B.
W77-09298

INSTITUTIONAL CONSTRAINTS ON WATER RESOURCE DEVELOPMENT IN ARID LANDS.
For primary bibliographic entry see Field 6E.
W77-09316

PREDICTING STORMFLOW AND PEAKFLOW FROM SMALL BASINS IN HUMID AREAS BY THE R-INDEX METHOD.
Georgia Univ., Athens. School of Forest Resources.
J. D. Hewlett, G. B. Cunningham, and C. A. Troendle.
Water Resources Bulletin, Vol. 13, No. 2, p 231-253, April 1977. 8 fig, 6 tab, 18 ref.

Descriptors: *Forecasting, *Storm runoff, *Peak discharge, *Forest watersheds, Humid areas, Model studies, Mathematical models, Equations, Watersheds(Basins), Precipitation(Atmospheric), Rainfall-runoff relationships, Forests, Discharge(Water), Storms, Rainfall, Runoff, Surface waters, Hydrology, Methodology.
Identifiers: *Eastern U.S., *R-index method.

The R-index method was proposed as a practical tool in forest and wildland management. Similar to the SCS runoff curve number method, the R-index method requires no prior assumptions about infiltration capacities of forest lands, but the method calls for the mapping of all first-order streams for the average storage capacity index R, i.e., the mean hydrologic response of the source areas. Tested against the runoff curve method on four independent basins, predictions by the R-index method were considerably more accurate when field information normally available to planners and managers was used in both methods. (Sims-ISWS) W77-09334

ON THE FLUCTUATIONS IN LEVELS OF CLOSED LAKES.
Commonwealth Scientific and Industrial Commission.
For primary bibliographic entry see Field 2H.
W77-09338

BAYESIAN GENERATION OF SYNTHETIC STREAMFLOWS, 2. THE MULTIVARIATE CASE.
Simon Bolivar Univ., Caracas (Venezuela).
For primary bibliographic entry see Field 2E.
W77-09349

THE USE OF THE PEARSON TYPE 3 AND LOG PEARSON TYPE 3 DISTRIBUTIONS REVISITED.
National Inst. of Scientific Research, Quebec.
For primary bibliographic entry see Field 2E.
W77-09352

FLOOD PLAIN INFORMATION: RIO SAN JOSE, PUEBLO OF ACOMA, NEW MEXICO.
Army Engineer District, Albuquerque, N.M.
Prepared by Ken O'Brien and Associates for the Army Corps of Engineers and the Pueblo of Acoma Council, June, 1975. 30 p, 1 fig, 25 plates, 6 tab.

Descriptors: *Floods, *Flood hazard, *Flood damage, *Flood peak, *Flood plains, *Flood profiles, Flood flow, Flow characteristics, *New Mexico, Flood plain zoning, Flood forecasting, Flood frequency, Flood proofing, Non-structural alternatives.
Identifiers: Intermedial Regional Flood, *Rio San Jose(NM), Rinconada Creek(NM), Largo Creek(NM), McCarty(NM), *Acoma Indian Reservation(NM).

Flood hazard areas adjoining the Rio San Jose, Rinconada Creek and Largo Creek, within the Acoma Indian Reservation located in New Mexico, are analyzed. The study area extends 11.1

miles along the Rio San Jose between the east boundary of the reservation and McCartys. Measured from the confluence with Rio San Jose, 2.16 miles of Rinconada Creek and 1.05 miles of Largo Creek are studied. Drainage areas of Rio San Jose at Rinconada Creek is 949 square miles, Rinconada Creek at Rio San Jose, 34 sq. mi., Rio San Jose at Largo Creek, 915 sq. mi., and Largo Creek at Rio San Jose, 74 sq. mi. Runoff for most streams in the study area is intermittent; it is caused by general summer storms and thunderstorms. There is little development in the flood plain. Stream gaging stations on the Rio San Jose have been maintained intermittently since 1914. In recent years flooding has occurred in 1965, 1972 and 1973. The channels of all three streams are well defined. Obstructions to flow include brush, flumes, bridges, culverts and pipeline crossings. At river mile 51.48 the Standard Project Flood would flow at 51,600 cubic feet per second (cfs), rise 7.6 feet at 0.9 feet per hour and last 38 hours. The Intermediate Regional Flood would peak at 16,900 cfs, rise 3.0 feet at 0.7 feet per hour and last 17 hours. Velocities in main channel and overbank would reach 4.5 and 2.7 feet per second for the SPF, and 4.2 and 1.1 for the IRF. Guidelines for flood plain management are presented, including zoning, building codes, floodproofing measures, health regulations, governmental development policies, and flood forecasting. The report does not present specific plans or recommendations. (Gentry-NC)

W77-09363

FLOOD PLAIN INFORMATION: BIG AND LITTLE FOSSIL CREEKS, FORT WORTH, TEXAS. Army Engineer District, Fort Worth, Tex. Prepared for the City of Fort Worth, Texas, May 1974. 46 p, 6 tab, 23 plates, 10 fig, 1 exhibit.

Descriptors: *Texas, *Maximum probable flood, *Flood data, *Non-structural alternatives, Floods, Flooding, Flood flow, Flood forecasting, Historic floods, Flood frequency, Flood stages, Peak discharge, Flood plains, Flood protection, Flood plain zoning, Flood plain insurance, Building codes, Land use, Planning, Zoning, Standard Project Flood.

Identifiers: *Big Fossil Creek(TX), *Little Fossil Creek(TX), Fort Worth(TX), Tarrant County(TX), Intermediate Regional Flood.

The Big Fossil Creek watershed is located in north central Tarrant County in north central Texas. The principal city in the watershed is Fort Worth. Many residential and commercial developments are on or adjacent to the flood plain. Flood data were obtained from two stream gages maintained by the U.S. Geological Survey (USGS) since January 1959, a third USGS gage maintained since 1968, newspaper records, the Texas Highway Department, City Engineering Departments, and field investigations. The main flood season is spring and fall and results from prolonged or successive storms producing heavy rainfall. The greatest recorded flood flow on Big Fossil Creek occurred on September 7, 1962, discharging 27,000 cubic feet per second (cfs) and cresting at 516.38 feet mean sea level datum (MSL). The Intermediate Regional Flood is expected to discharge 41,300 cfs on Big Fossil Creek, while the Standard Project Flood is expected to discharge 56,400 cfs. Fifty-two of the 68 bridges in the watershed will contribute to the flood problem since they would be overtopped by the SPF. Although intended for informational purposes, this report recommends and describes non-structural flood control measures, including zoning, subdivision controls, building codes, health codes, fee purchase of lands for open space, acquisition of flooding easements, and flood insurance. (Nessa-NC)

W77-09364

FLOOD PLAIN INFORMATION: WARD CREEK AND TRIBUTARIES, BATON ROUGE, LOUISIANA, NO. 2. Army Engineer District, New Orleans, La.

Prepared for the City of Baton Rouge, October 1972. 32 p, 20 fig, 48 plates, 6 tab.

Descriptors: *Louisiana, *Floods, *Flood forecasting, *Peak discharge, Flow characteristics, *Flood plains, Flood flow, Streamflow forecasting, Hurricanes, Historic floods, Flood data, Flood frequency, Flow duration, Channels, Flood protection, Channel improvement, Standard Project Flood.

Identifiers: *Ward Creek(LA), Dawson Creek(LA), Bayou Duplanier(LA), North Branch Ward Creek(LA), Baton Rouge(LA), Intermediate Regional Flood.

Ward Creek, draining 44.7 square miles, is a tributary of Bayou Manchac. The flood plain is narrow within the city of Baton Rouge but broadens quickly downstream. The tributaries of Ward Creek included in the study are Dawson Creek, Bayou Duplanier and North Branch Ward Creek, which drain 16.3, 7.7 and 7.8 square miles, respectively, areas which lie mostly within Baton Rouge. The flood plains are largely undeveloped, containing a few concentrations of single-family dwellings. The U.S. Geological Survey gage records on Ward Creek are available from 1954. The main flood season is winter and spring. Vegetation, bridges, culverts and buildings obstruct flood flow. The only existing flood reduction measures are channel improvements, which have effectively reduced flood stages since 1954. The highest flood on record on Ward Creek occurred in May 1953, cresting at 24.7 feet mean sea level (MSL), with a peak discharge of 3,840 cubic feet per second (cfs). The flow at the mouth of Ward Creek for an Intermediate Regional Flood and Standard Project Flood is 13,500 and 17,800 cfs, respectively. Channel velocities for both floods along Ward Creek would be 3 to 6 ft/sec (4 to 10 ft/sec in the concrete lined portion). Backwater from Bayou Manchac may cause a second flood peak along Ward Creek: the first 6 to 12 hours after bankfull, and then another after 18 to 30 hours. Peak stages for the tributaries should occur 3 to 11 hours after bankfull. (Gentry-NC)

W77-09365

FLOOD PLAIN INFORMATION: VERMILION RIVER AND TRIBUTARIES, LAFAYETTE, LOUISIANA.

Army Engineer District, New Orleans, La. Prepared for City of Lafayette, LA., September 1973. 67 p, 44 fig, 43 plates, 10 tab.

Descriptors: *Floods, *Peak discharge, *Flood plains, Streamflow forecasting, Flood forecasting, Hurricanes, Historic floods, Flood data, Flood frequency, Flow duration, Flow characteristics, Flood damage, Channels, Standard Project Flood, Flood protection, Channel improvement, Flood flow, *Louisiana.

Identifiers: *Vermilion River(LA), Lafayette(LA), Intermediate Regional Flood.

The upper reaches of the Vermilion River, around Lafayette(LA), located in Lafayette Parish in southwest Louisiana, are studied. Most development in Lafayette, a town of 71,500 people, is situated on high ridges above the flood plain, but the flood plain includes extensive residential, commercial and industrial development. The U.S. Geological Survey and the Corps of Engineers have maintained gages and flood records on the Vermilion River. Floods occur usually in winter and spring, but may be caused by severe thunderstorms and hurricanes which occur from June to October. The greatest known flood occurred in August 1940 and approximated the Standard Project Flood; it occurred as a consequence of a tropical hurricane. The most recent significant flood occurred in December 1971. The 1940 flood crested at 22.02 feet mean sea level (MSL) at the Pinhook-Surrey Bridges gaging station, while the 1971 flood crested at 11.71 feet MSL. Obstructions to floodflow include vegetation, bridges, and highway and railroad embankments. Channel im-

provements were made between 1944 and 1957. Peak flows at the Pinhook Bridge for the Intermediate Regional Flood (IRF) and Standard Project Flood (SPF) are 5,800 cubic feet per second (cfs) and 12,700 cfs, respectively. During an IRF flow velocities range from 1.2 to 8.5 feet per second in the main channel, 0.3 to 2.0 ft/sec overbank. Floods rise slowly and stay out of banks for long periods of time. (Gentry-NC)

W77-09366

FLOOD PLAIN INFORMATION, LITTLE RIVER, HANOVER COUNTY, VA. Army Engineer District, Norfolk, Va. Prepared for Hanover County, VA, May 1976. 24 p, 6 tab, 5 fig, 22 plates.

Descriptors: *Floods, Flood data, *Flood control, *Historic floods, *Maximum probable floods, *Virginia, Flood peak, Flood protection, Flood plains, Flood flows, Flood damage.

Identifiers: *Little River(VA), Hanover County(VA), Louisa County(VA), 100-year flood, 500-year flood.

The study area includes approximately 29 miles of the Little River in Hanover County and Louisa County, VA. The flood plain consists mostly of wooded areas and open space, but the rapid development taking place in the watershed could soon impinge upon the flood plain. Flood data dating back to 1961 were obtained from a Virginia State Water Control Board stream gage near Doswell, U.S. Geological Survey 1:24,000 scale topographic sheets, and precipitation records. Supplementary data were obtained from newspaper files and historical documents. Floods occur at any time of year and are caused by intense short term rainfall or tropical disturbances. The worst flood of record occurred on August 21, 1969, cresting at 143.39 feet mean sea level (MSL), which is 6 feet above flood stage, and discharging 12,000 cubic feet/sec (cfs) at the Doswell gage. Flood damage exceeded \$250,000. The 500-year flood is expected to crest at 144.3 feet MSL and discharge 17,800 cfs at the mouth of the Little River; the 100-year flood will crest at 143.1 feet MSL and discharge 10,900 cfs. Some existing residential property would be damaged by these floods. There are no existing or planned flood control structures that affect the 100- or 500-year flood. The Statewide building code requires protection of buildings from the 100-year flood. The report does not provide solutions to flood problems, but provides a basis for adoption of land use controls to guide land development in the future. (Nessa-NC)

W77-09367

FLOOD PLAIN INFORMATION, STONY RUN CREEK, HANOVER COUNTY, VA. Army Engineer District, Norfolk, Va.

Prepared for Hanover County, VA, September 1976. 22 p, 6 tab, 10 plates, 5 fig.

Descriptors: *Floods, *Flood data, *Flood control, *Maximum probable flood, *Historic floods, *Virginia, Flood peak, Flood protection, Flood damage, Flood plains.

Identifiers: *Stony Run Creek(VA), Topotomoy Creek(VA), Hanover County(VA), 100-year flood, 500-year flood.

The study area includes approximately 14 miles of Stony Run Creek in Hanover County, VA. The watershed is 17.6 sq mi in area. The flood plain consists mostly of wooded areas and open space, but the rapid development taking place in the watershed could soon impinge upon the flood plain. Since there are no stream gages on Stony Run Creek, data from the gaging station on Topotomoy Creek in an adjacent watershed were used as a surrogate. These data are considered indicative of the flood occurrences on Stony Run Creek. They date back to 1945. Supplementary data on Stony Run Creek floods were obtained

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Group 4A—Control Of Water On The Surface

from U.S. Geological Survey 1:24,000 scale topographic maps, precipitation records, newspaper files, and historical documents. The worst flood on Topotomoy Creek occurred on August 13, 1955, cresting at 124.95 feet mean sea level and discharging 748 cubic feet/sec (cfs). At the mouth of Stony Run Creek, the 500-year is expected to discharge 12,000 cfs and crest at approximately 27.5 feet MSL. The 100-year flood should discharge 7,300 cfs and crest at approximately 122.0 feet MSL. There are no existing or planned flood control structures that affect the 100- or 500-year flood. The statewide building code requires protection of buildings that would be affected by the 100-year flood. The report does not provide solutions to flood problems; but provides a basis for adoption of land use controls to guide future flood plain development. (Nessa-NC) W77-09368

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER AND LILLIBRIDGE CREEK, BOROUGH OF PORT ALLEGANY, PENNSYLVANIA.

Army Engineer District, Pittsburgh, Pa. Prepared for the Borough of Port Allegany and the Pennsylvania Department of Environmental Resources, December 1973. 45 p, 30 fig, 7 plates, 8 tab.

Descriptors: *Pennsylvania, *Floods, *Peak discharge, Flow characteristics, *Flood plains, Flood flow, Streamflow forecasting, Flood forecasting, Historic floods, Flood data, Flood frequency, Flow duration, Flood damage, Channels, Flood plain insurance, Control structures, Dams, Standard Project Flood.

Identifiers: Port Allegany(PA), *Allegheny River(PA), Lillibridge Creek(PA), Intermediate Regional Flood.

The flood problems of the Borough of Port Allegany (PA) at the confluence of Lillibridge Creek and the Allegheny River are reviewed. The valley floor of the Allegheny River at Port Allegany is approximately 0.5 miles wide, with a bed slope of approximately three feet per mile. Developments in the Allegheny River flood plain include light industrial, commercial and residential structures, and notably the tracks of the Penn Central Railroad, the municipal sewage disposal plant and the Pierce Glass Company manufacturing plant. The Lillibridge Creek flood plain is largely undeveloped. The main flood season is November through April. Obstructions to flood flow include vegetation, dams, bridges and culverts. Earth dikes along the right bank of both river and creek, and participation in the National Flood Insurance Program are the current flood damage reduction measures. U.S. Geological Survey and National Weather Service gage records were used to obtain data. The highest recent flood occurred in June 1972, crested at 19.65 feet, discharging 22,000 cubic feet per second (cfs). The Intermediate Regional Flood (IRF) for the river and creek has a peak discharge of 28,000 cfs and 2,200 cfs respectively; for the Standard Project Flood (SPF) peak discharge is 42,000 cfs and 3,700 cfs respectively. The Allegheny River, for an IRF and SPF, will achieve channel velocities of 9 and 10 ft/sec, and overbank velocities of 3 ft/sec for both floods. Channel velocities of an IRF and SPF on Lillibridge Creek will be 13 and 15 ft/sec respectively, 3 and 4 ft/sec overbank. (Gentry-NC) W77-09369

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, FOREST COUNTY, PENNSYLVANIA.

Army Engineer District, Pittsburgh, Pa. Prepared for Forest County Planning Commission and the Pennsylvania Department of Environmental Resources, December 1974. 26 p, 10 fig, 10 plates, 6 tab.

Descriptors: *Pennsylvania, *Floods, *Peak discharge, Flow characteristics, *Flood plains,

*Standard Project Flood, Streamflow forecasting, Flood forecasting, Historic floods, Flood frequency, Flood damage, Flood protection, Flood stages. Identifiers: Intermediate Regional Flood, *Allegheny River, Tionesta(PA), Forest County(PA), Tionesta Lake(PA), Tionesta Dam(PA), Kinzua Dam(PA).

The study reach is 14.1 miles of the Allegheny River lying within Forest County (PA). The average bed slope within the study reach is 3.3 feet per mile, with valley floor widths ranging from 0.1 to 0.5 mile. Development in the flood plain consists largely of recreation facilities, and private and public forest and park lands. The main flood season is December through April. U.S. Geological Survey and U.S. Weather Bureau station records from stream gaging stations were used to obtain data for flood elevations. Additional information was obtained from newspaper files and historical documents and records. Tionesta and Kinzua Dams are the principal flood damage reduction measures. Obstructions to flood flow include vegetation, dams, bridges, culverts and ice jams. The greatest recorded flood occurred on March 8, 1956, cresting at 17.2 feet at the West Hickory gage and discharging 101,000 cubic feet per second (cfs). Peak discharge for an Intermediate Regional Flood (IRF) and Standard Project Flood (SPF) is 58,800 cfs and 73,000 cfs, respectively. Channel velocities for an IRF and SPF are 11 and 12 ft/sec respectively, and 3 ft/sec overbank velocity for both floods. Times of rise are 13.0 hours for IRF, 14.5 hours for the SPF. (Gentry-NC) W77-09370

WEST FORK DES MOINES RIVER AND PERKINS CREEK FLOOD PLAIN INFORMATION, WINDOM, MINNESOTA.

Army Engineer District, Rock Island, Ill. Prepared for the State of Minnesota Conservation Department, June 1972. 62 p, 11 tab, 42 fig, 14 plates.

Descriptors: *Flood control, *Flood plain zoning, *Non-structural alternatives, *Building codes, *Minnesota, Flood peak, Historic flood, Flood data, Flood plain, Standard Project Flood. Identifiers: Windom(MN), Cottonwood County(MN), *West Fork Des Moines River(MN), *Perkins Creek(MN), Intermediate Regional Flood.

The study area includes 7 miles of the West Fork Des Moines River and 2.5 miles of the Perkins Creek flood plains in Windom, Cottonwood County, Southwest Minnesota. The drainage area at Windom is 1,110 square miles. Some residential and commercial establishments rest on or are adjacent to the flood plain. The highest record flood (in 1969) caused \$175,000 in damages and evacuation of 128 families. Continuous flow records are not available. Precipitation and runoff data were collected after major floods in 1965 and 1969. Newspaper files and historical documents yielded information on past floods. Major floods occur from April through July and are caused by the spring melt, storms, or both. Six bridges and one dam cross the Des Moines, while Perkins has 5 road crossings. Natural obstructions include trees and vegetation. Minnesota law fixes mandatory minimum standards for flood plain management. The worst flood occurred on April 10-11, 1969, cresting at 7.54 feet. The gaged velocity was 15,700 cubic feet/second. The Intermediate Regional Flood (IRF) would be 1.6 feet higher and the Standard Project Flood (SPF) would be 5.6 feet higher. More extensive damage is expected from an IRF or SPF due to wider extent, greater depths, and higher flow velocities. Health problems could develop due to flooded septic tanks. A levee is planned along the north bank of the Des Moines, but non-structural remedies such as building codes, zoning and subdivision control are the principal controls relied upon. (Nessa-NC) W77-09371

FLOOD PLAIN INFORMATION: LITTLE DRY FORK, LOVE BRANCH, BURGER BRANCH, CITY OF ROLLA, MISSOURI.

Army Engineer District, St. Louis, Mo. Prepared for City of Rolla, MO., August, 1974. 23 p, 10 fig, 16 plates, 2 tab.

Descriptors: *Missouri, *Floods, *Maximum probable flood, *Flood data, *Flood peak, Flood flow, Streamflow forecasting, Flood forecasting, Flood profiles, Historic floods, Flood frequency, Flow duration, Flow characteristics, Flood plains, Flooding, Standard Project Flood, Land use, Planning.

Identifiers: Little Dry Fork(MO), Love Branch(MO), Burger Branch(MO), Rolla(MO), Intermediate Regional Flood.

The study area includes the Little Dry Fork, Love Branch, and Burger Branch in the vicinity of Rolla, Missouri. The flood plain in the lower half of the watershed is agricultural. Residential, commercial, and industrial developments lie on or adjacent to the remaining flood plain areas. Flood data were obtained from rainfall records, U.S. Geological Survey (USGS) topographic maps, historical documents, newspaper files, and gage records from similar creeks in the area. Floods usually occur from May to September but they will occur at all times of the year. Floods are caused by high intensity, short duration rainfalls. Flood flows have high peaks, short duration, and low volumes. Damaging floods have occurred regularly in the past, but documentation of the magnitudes and flood stages do not exist. At the mouth of the Little Dry Fork, Love Branch and Burger Branch, peak Standard Project Flood flows are expected to be 27,400, 17,500 and 7,400 cubic feet per second (cfs), respectively. In the same order, peak Intermediate Flood flows will be 14,400, 10,900, and 5,100 cfs, respectively. Although not intended to provide solutions to flood problems, this report does provide the information necessary for the development of land use controls to guide flood plain development. (Nessa-NC) W77-09372

FLOOD PLAIN INFORMATION: ST. CHARLES COUNTY, MISSOURI, PART 3, CUIVRE RIVER AND TRIBUTARIES.

Army Engineer District, St. Louis, Mo. Prepared for County of St. Charles, Missouri, September 1973, 30 p, 15 fig, 25 plates, 4 tab.

Descriptors: *Missouri, *Floods, *Maximum probable flood, *Flood data, *Flood peak, Flood flow, Streamflow forecasting, Flood forecasting, Flood profiles, Historic floods, Flood frequency, Peak discharge, Flow duration, Flow characteristics, Flood plains, Land use, Planning, Standard Project Flood.

Identifiers: *Cuiivre River(MO), Indian Camp Creek(MO), Big Creek(MO), McCoy Creek(MO), St. Charles County(MO), Old Monroe(MO), Intermediate Regional Flood.

The study area involves 75 square miles of the Cuiivre River watershed, including Big Creek, Indian Camp Creek and McCoy Creek, and the City of Old Monroe. The entire City of Old Monroe can be surrounded by flood water, and numerous other developments exist in the flood plain. Flood data were obtained from precipitation records, newspaper files, field reconnaissance, and U.S. Geological Survey (USGS) topographic maps. Floods occur at any time of year. Backwater flooding from the Mississippi River can extend the duration of a flood. The worst flood of record occurred in October, 1969. On that date, the Cuiivre, Big Creek, McCoy Creek and Indian Camp Creek crested at 451.0, 458.9, 475.4, and 478.3 feet, respectively. These crests compare with predicted Intermediate Regional Flood crests of 453.7, 460.7, 476.2 and 481.6 feet, respectively, and Standard Project Flood crests of 457.1, 463.4, 477.6, and 482.9 feet, respectively. Eight of the ten bridges in the area will obstruct IRF flows. Although not in-

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Control Of Water On The Surface—Group 4A

tended to provide solutions to flood problems, this report does provide the information necessary for the development of land use controls to guide flood plain development. (Nessa-NC)
W77-09373

FLOOD PLAIN INFORMATION: STE. GENEVIEVE, MISSOURI: MISSISSIPPI RIVER, NORTH AND SOUTH GABOURI CREEKS.
Army Engineer District, St. Louis, Mo.
Prepared for City of Ste. Genevieve, MO., September 1974. 34 p, 15 fig, 22 plates, 5 tab.

Descriptors: *Missouri, *Mississippi River, *Maximum probable flood, *Flood data, Floods, Flood flow, Streamflow forecasting, Flood forecasting, Flood profiles, Historic floods, Flood frequency, Flood peak, Flood plains, Standard Project Flood.

Identifiers: *North Gabouri Creek(MO), *South Gabouri Creek(MO), Ste. Genevieve(MO), Intermediate Regional Flood.

The study area includes 3.41 miles of North Gabouri Creek and 3.41 miles of South Gabouri Creek, the Mississippi River flood plain, and the City of Ste. Genevieve. Commercial and residential developments lie on all three flood plains. Flood data were obtained from precipitation records, U.S. Geological Survey (USGS) quadrangle maps, gage records from similar creeks in the area, field observations and newspaper accounts. Floods on the creeks can occur at any time of year and are caused by heavy local rains, Mississippi River backwater, or both. Flooding along the Mississippi occurs in the spring and early summer when widespread rains can be augmented with melting snow. The worst floods on the two creeks occurred on April 27, 1957, while the worst Mississippi River flood occurred on April 28, 1973. On these occasions, North and South Gabouri Creeks crested at 393.0 and 394.5 feet, mean sea level datum (MSL), while the Mississippi crested at 390.5 feet MSL. These values compare to Standard Project Flood elevations of 401.5, 399.4 and 399.0 ft MSL on the North and South Gabouri Creeks, and the Mississippi, respectively; and Intermediate Regional Flood crests of 397.0, 396.0 and 396.0 MSL on the North and South Gabouri Creeks, and Mississippi River, respectively. (Nessa-NC)
W77-09374

FLOOD PLAIN INFORMATION, ADAMS CREEK AND TRIBUTARIES, TULSA AND WAGONER COUNTIES, OK.
Army Engineer District, Tulsa, Okla.
Prepared for the City of Broken Arrow, OK, December 1976. 28 p, 5 tab, 4 fig, 18 plates.

Descriptors: *Floods, *Flood data, *Flood control, *Non-structural alternatives, *Flood plain zoning, Building codes, Flood peak, Maximum probable flood, Flood plains, *Oklahoma.
Identifiers: *Adams Creek(OK), Broken Arrow(OK), Tulsa County(OK), Wagoner County(OK), 100-year flood, 500-year flood, Development policies, Stream crossing design.

The study area includes about 10 miles of Adams Creek and 11.4 miles of selected tributaries in the vicinity of the city of Broken Arrow in Tulsa and Wagoner Counties, OK. Some residential properties exist on the flood plain and rapid development threatens further flood plain encroachment. Floods occurred in the study area in 1943, 1970, 1974, and 1976. Flood data were obtained from newspaper files, historical documents, and precipitation records. High water marks of the April 1970, June 1974, and May 1976 floods were also used. No stream gaging records are available. The main flood season occurs in the spring and summer months, and results from local intense thunderstorms. The most severe flood was produced by the storm of April 1970. High water marks for the May 30, 1976 flood are shown on the

flood profiles in this report, along with the 10-, 50-, 100-, and 500-year frequency floods. The 1976 flood crested approximately at the level of the 10-year frequency flood. The 500-year frequency flood is expected to crest 4.3 feet above low bank on Adams Creek and discharge 12,300 cubic feet/sec (cfs). The 100-year frequency flood should crest 3.7 above low bank and discharge 9,600 cfs. Twelve of the fifteen bridges in the study area will exacerbate the flood problem since they will be overtopped by the 100-year flood. Although intended for informational purposes, this report describes and recommends non-structural flood control measures, including building codes, health regulations, development policies, flood plain regulations, and appropriate design of future stream crossings. (Nessa-NC)
W77-09375

FLOOD PLAIN INFORMATION: HOLLIDAY AND MCGRATH CREEKS, WICHITA FALLS, TEXAS.
Army Engineer District, Tulsa, Okla.
Prepared for City of Wichita Falls, May 1976, 33 p, 7 fig, 10 plates, 5 tab.

Descriptors: *Texas, *Floods, Flood flow, *Flood forecasting, *Flood profiles, *Peak discharge, *Flow duration, Flow characteristics, *Flood plains, River flow, Historic floods, Flood data, Flood frequency, Flood stages, Standard Project Flood, Flood protection, Non-structural alternatives, Flood plain zoning, Flood plain insurance, Building codes, Land use, Zoning, Dams, Reservoirs.

Identifiers: Wichita Falls(TX), *Holliday Creek(TX), *McGrath Creek(TX), Lake Wichita(TX), Intermediate Regional Flood.

The study reach comprises 11.4 miles of Holliday Creek and 2.0 miles of McGrath Creek, including their drainage area of 170 square miles, located in and around Wichita Falls, Texas. Most floods are the result of thunderstorms and frontal movements, occurring most frequently from May through October. Lake Wichita is located on mile 9.6 of Holliday Creek but is used primarily for water supply purposes. There is urban, commercial and industrial development along most of Holliday Creek below Lake Wichita. The city does not have zoning ordinances but can regulate development through the issuance of building permits and approving subdivisions. There are no stream gaging stations in the study area. Data were obtained from U.S. Geological Survey measurement for the 1950 flood and from other available sources. Flood data are limited. Major floods are known to have occurred in 1915, 1941, 1950 and 1975. At river mile 2.72 peak discharge for an Intermediate Regional Flood (IRF) and Standard Project Flood (SPF) is 11,700 cubic feet per second (cfs) and 28,000 cfs, respectively. Floods will rise at a rate of 2.8 and 1.9 feet per hour, reaching a height of 5.3 and 10.5 feet above bankful for the IRF and SPF, respectively. For the IRF and SPF channel velocity would be 5.4 and 3.4 feet per second, 0.7 and 1.1 ft/sec in the overbank areas. Guidelines are presented for flood plain management, with non-structural alternatives such as zoning and subdivision regulations discussed. (Gentry-NC)
W77-09376

WATER TABLE LOWERING BETWEEN TWO DRAINAGE DITCHES IN NATURALLY LAYERED SOILS ON A SLOPE, (IN GERMAN), C. Schuster.
Eidg Anst Forstl Versuchswes Mitt 50(1), 84 p, 1974.

Descriptors: *Water table, *Drainage, Soils, *Slopes, Soil stability, Slope stability, *Clays, Simulation analysis.

Observations of water table lowering in naturally layered soils are compared with the results of a simulation for non-stationary conditions (Luthin

and Richard, 1965). Stationary design formulas are compared with the drainage effect in the field. The study site consisted of 2 parallel contour ditches, 270 cm apart, which drained a soil, rich in clay, to an impervious layer at 65 cm depth.—Copyright 1976, Biological Abstracts, Inc.
W77-09448

ECONOMIC INCENTIVES FOR LAND USE CONTROL.
CONSAD Research Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 6B.
W77-09467

FLOODPLAIN ZONING—AN ALTERNATIVE APPROACH TO LAND REGULATION IN FLOOD HAZARD AREAS: A CASE STUDY, KALAMAZOO, MICHIGAN.
For primary bibliographic entry see Field 6F.
W77-09532

LAND USE CONTROL IN THE COASTAL ZONE: THE DELAWARE EXAMPLE.
Natural Resources Law Inst. Portland, Ore.
For primary bibliographic entry see Field 6F.
W77-09533

REGULATING DEVELOPMENT ALONG THE CALIFORNIA COAST.
California Univ., Davis. Environmental Studies Program.
P. Sabatier.
Journal of Soil and Water Conservation, Vol 3, No 4, p 146-51 July/August 1976. 2 photo, 1 tab, 22 ref.

Descriptors: *Coastal engineering, *Land use, *Regional development, *Conservation, *California, Legislation, Planning, State governments, Beaches, Beach erosion, Land management, Land development, Landscaping, Coasts, Shore protection.

In 1972 the voters of California passed an initiative that called for the establishment of a state coastal commission and six regional commissions. They will be in existence only until the 1976 legislature passes a comprehensive coastal plan; however, they already have had a great impact on California coastal development. As would be expected, developers and conservationists lined up on opposite sides of the fence concerning the proposed regulation of the coastline. In California, though, the developers suffered one defeat after another. The regional commissions bore down hard on all planned development. Among the factors that were examined were: cumulative impacts on land use; consistency with existing development; preservation of open space (both in terms of access and viewing); and transportation. Appeals were taken to the state commission, but they were approved only rarely over the regional boards' objections. Furthermore, the appellate courts have repeatedly upheld these original rulings, giving greater priority to conservation than to development. (Frank-Florida)
W77-09534

THE LEGAL IMPLEMENTATION OF COASTAL ZONE MANAGEMENT: THE NORTH CAROLINA MODEL.
North Carolina Univ. at Chapel Hill. School of Law.
For primary bibliographic entry see Field 6E.
W77-09547

ARTIFICIAL WATER REGULATION OF LAKE SUPERIOR—A TAKING.
Washington Coll. of Law D. C.
For primary bibliographic entry see Field 6E.
W77-09551

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control Of Water On The Surface

A SCREENING MODEL FOR FLOOD CONTROL PLANNING,
California Univ., Los Angeles.
A. R. Mokashi.
PhD Thesis, 1976. 123 p.

Descriptors: *Model studies, *Mathematical models, *Reservoirs, *Flood control, Flood protection, Flood data, Planning, River regulation, Reservoir design, Reservoir sites.
Identifiers: Screening model.

In order to reduce damages, a screening model was developed to aid determination of the number, location, and size of reservoirs at sites of potential flooding. Plans are judged by this model and then subjected to detailed simulation analysis for final selection. The model is a mathematical programming optimization model. The deterministic model uses the most severe historical floods as hydrologic input. Capacities of potential reservoirs are chosen by balancing annual damage against annual average costs of reservoir storage to prevent damage. For large basins, the system is divided into subsystems which are separately subjected to modeling. Design parameters employed by the screening model serve as input data for detailed simulation analysis. The chosen system must produce the maximum reduction in average annual damage. (Collins-FIRL)
W77-09595

4B. Groundwater Management

GROUNDWATER RESOURCES OF AUSTRALIA.
Australian Water Resources Council, Canberra.
Australian Government Printing Office, Canberra, 1975. 151 p., 30 fig., 11 plate, 27 tab., 3 append.

Descriptors: *Australia, *Groundwater resources, *Water resources development, Water utilization, Saline water, Bibliographies, Foreign countries, Foreign research, Maps, History, Groundwater, Aquifers, Hydrological aspects, Water quality, Groundwater basins, Aquifer systems, Data collections, Water supply, Unconsolidated aquifers, Groundwater availability, Geology, Climates.
Identifiers: Groundwater quality.

In 1965 the first substantial assessment of Australia's groundwater resources was published by the Australian Water Resources Council. The present publication updated and expanded the information published in 1965. Included in the new publication were four reference maps, extensive notes, and a bibliography. Appendix I contained a list of government authorities from whom more detailed information may be obtained. A glossary of important groundwater terms was provided in Appendix II, and a table of metric conversions appeared in Appendix III. (Froehlich-ISWS)
W77-09103

THE AGE OF GROUNDWATER IN THE LINCOLNSHIRE LIMESTONE, ENGLAND AND ITS RELEVANCE TO THE FLOW MECHANISM,
Department of the Environment, Reading (England). Central Water Planning Unit.
For primary bibliographic entry see Field 2F.
W77-09107

RECHARGE TO BUNTER SANDSTONE DETERMINED FROM LYSIMETERS,
Institute of Geological Sciences, London (England). Dept. of Hydrogeology.
For primary bibliographic entry see Field 2F.
W77-09108

VALIDATION OF AN AXISYMMETRIC PSEUDO-UNCONFINED TIME-VARIANT DIGITAL MODEL,
Birmingham Univ. (England). Dept. of Mechanical Engineering.

For primary bibliographic entry see Field 2F.
W77-09112

NON-PENETRATING WELL IN A SEMI-FINITE MEDIUM WITH NON-LINEAR FLOW,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W77-09114

PROFILE DESATURATION DURING SEDIMENT DEPOSITION IN A GROUNDWATER RECHARGE TRENCH,
Mississippi Agricultural and Forestry Experiment Station, Mississippi State. Dept. of Agronomy.
K. K. Watson, and F. D. Whisler.
Journal of Hydrology, Vol 33, No 3/4, p 397-401, 1977. 1 fig, 7 ref.

Descriptors: *Groundwater recharge, *Artificial recharge, *Model studies, Mathematical models, Pit recharge, Sediments, Sedimentation, Seepage, Aquifers, Sands, Infiltration, Hydraulic conductivity, Soil water movement, Groundwater movement, Porous media, Groundwater.
Identifiers: *Recharge trenches.

When off-line recharge trenches are used for the artificial recharge of unconfined aquifers, the intake rate often decreases due to the deposition of a sediment layer on the surface of the recharge profile. The buildup of the impeding layer causes progressive hydraulic changes in the profile. The significance of the changes in relation to the intake rate depends on whether air is able to enter the pores of the saturated porous material beneath the trench when the air entry value of the material is exceeded. Flow rates were calculated for recharge through a profile of no. 17 sand for conditions of 'no air access' and 'adequate air access'. (Sims-ISWS)
W77-09115

DECLINING POTENTIOMETRIC LEVELS IN FORT WALTON BEACH AREA, FLORIDA,
Northwest Florida Water Management District, Tallahassee.
Z. Qureshi.
Water Resources Bulletin, Vol 12, No 6, p 117-123, December 1976. 3 fig, 3 ref.

Descriptors: *Potentiometric level, *Florida, *Drawdown, *Gulf of Mexico, Limestones, Water levels, Water quality, Aquifers, Pumping, Water wells, Saline water intrusion, Water management (Applied), Alternate planning, Water supply development, Aquicludes.
Identifiers: *Water level decline, *Floridan aquifer, Limestone aquifers.

The Fort Walton Beach area presently is faced with an excessive drawdown of the potentiometric level in the upper Floridan aquifer. Based on available data, the potentiometric level in the Floridan aquifer has dropped 162 feet since 1936. The declining potentiometric level can lead to problems and possible loss of the natural resource on a long-term basis. However, if corrective measures or programs for proper management of groundwater resources are undertaken at this time, the potential problems may be averted. (Visocky-ISWS)
W77-09132

DETERMINATION OF DUG WELL DEBIT UNDER CONDITIONS OF DESERT PASTURE LANDS, (IN RUSSIAN),
O. B. Khellenov.
Probl Osvoeniya Pustyn'. 1, p 89-91, 1974.

Descriptors: *Water wells, *Dug wells, Water sources, *Water supply, Pumping, Livestock, Deserts, Pastures, *Arid land.
Identifiers: *USSR (Karakum).

Water inflow was determined to be dependent on time at different dug well debits applied to the ranges of Karakum (USSR). Dynamic water column, water intake capacity and total daily yield of wells were determined. The data were used to determine livestock distribution and to determine the best operational conditions of water-pumping devices.—Copyright 1975, Biological Abstracts, Inc.
W77-09310

TRANSFORM APPROACH TO SOLUTION OF GROUNDWATER FLOW EQUATIONS,
Nevada Univ., Reno. Water Resources Center; and Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 2F.
W77-09318

TYPE CURVES FOR RECOVERY OF A DISCHARGING WELL WITH STORAGE,
Nevada Univ. System, Reno. Water Resources Center.
For primary bibliographic entry see Field 2F.
W77-09340

THE SPACIAL DISTRIBUTION OF GROUNDWATER DISCHARGE INTO THE LITTORAL ZONE OF A NEW ZEALAND LAKE,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 2F.
W77-09341

FINITE-ELEMENT ANALYSIS OF GROUNDWATER FLOW IN MULTI-AQUIFER SYSTEMS, II. A QUASI THREE-DIMENSIONAL FLOW MODEL,
Kyoto Univ. (Japan). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2F.
W77-09362

SOIL NITRATES FOLLOWING FOUR YEARS CONTINUOUS CORN AND AS SURVEYED IN IRRIGATED FARM FIELDS OF CENTRAL AND EASTERN COLORADO,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-09429

SIMPLIFIED LONG TERM CONCEPT FOR EVALUATING LEACHING OF NITROGEN FROM AGRICULTURAL LAND,
Joint FAO/IAEA Div. of Atomic Energy in Agriculture, Vienna (Austria).
For primary bibliographic entry see Field 5B.
W77-09446

ENVIRONMENTAL IMPACTS OF HIGH LEVEL RADIOACTIVE WASTE DISPOSAL,
Pittsburgh Univ., Pa.
For primary bibliographic entry see Field 5C.
W77-09473

SECTION 1424(E) OF THE SAFE WATER DRINKING ACT: AN EFFECTIVE MEASURE AGAINST GROUNDWATER POLLUTION,
For primary bibliographic entry see Field 5G.
W77-09536

WATER LAW - WELL PERMITS - UNAPPROPRIATED WATER AND MAXIMUM UTILIZATION, HALL V. KUIPER, 510 P.2D 329 (COLO. 1973),
For primary bibliographic entry see Field 6D.
W77-09543

4C. Effects On Water Of Man's Non-Water Activities

URBANIZATION AND FLOODING - AN EXAMPLE.

Water Resources Engineers, Inc., Springfield, Va. R. P. Shubinski, and W. N. Fitch. In: Proceedings of the EPA Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 69-73, July 1976. 5 fig, 2 tab, 4 ref.

Descriptors: *Flood control, *Model studies, *Simulation analysis, *Design flood, *Design storm, *Rainfall-runoff relationships, *Watersheds(Basins), Management, Urbanization, Flooding, Hydrology, Statistical methods, Alternative planning, Networks, Systems analysis, *Virginia.

Identifiers: Four Mile Run watershed(Va).

The Four Mile Run watershed in Northern Virginia is a classical example of the development of flood problems with urbanization. The Corps of Engineers has planned \$29,000,000 in channel improvements to alleviate the problem, but the Congress, concerned that future development in the basin will create the problem again, required that a land management program be developed. The selected approach to land management is designed to determine effective structural and nonstructural methods of flood abatement; emphasis is on the nonstructural. The technical portions of the program rely upon the use of two stormwater models. The first model, STORM (Storage, Treatment, Overflow, Runoff Model), is a simple model based on the rational method. It was used to develop a statistical analysis of the basins' hydrology, thereby defining the design storm. Next, the sophisticated model WREM (Water Resources Engineers Model) was applied, using the design hydrology developed in STORM, to determine the response of the watershed to various control alternatives. The use of these models together yielded the best of both continuous simulation and single event simulation. The results of this modeling will be used to assign design shares for future development to each of the political subdivisions in the basin. (See also W77-09154) (Bell-Cornell) W77-09161

INFLUENCE OF VEGETATION MANAGEMENT ON YIELD AND QUALITY OF SURFACE RUNOFF.

Texas A and M Univ., College Station. Dept. of Range Science. F. E. Smeins.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 410. Price codes: A04 in paper copy, A01 in microfiche. Texas Water Resources Institute. College Station, Technical Report No. 84, April 1977. 47 p. 12 tab, 6 fig, 21 ref. OWRT C-6310(No. 5233)(1).

Descriptors: Sediments, Nitrogen, Infiltration, Nutrients, Water pollution, *Agricultural runoff, Surface runoff, *Vegetation effects, Watersheds(Basins), Water harvesting, *Water quality, *Texas, Great Plains, Water yield improvement, *Grazing, *Pasture management. Identifiers: *Edwards Plateau(Texas), Sonora Research Station(Tex), Sonora(Tex).

A study was conducted on the Edwards Plateau of Texas during 1974-76 to determine yield and quality of surface runoff as influenced by grazing management and site variables. Annually maximum runoff recorded was 12% of precipitation for a continuously, heavily grazed pasture in poor range condition. This same pasture had the highest runoff (39%) for a single rainfall event in July 1976. These results show that annually little runoff occurs, but for selected events significant amounts

of runoff may occur from poorly managed areas. Good grazing management can help to reduce the amount of runoff. Greater runoff increases potential for sediment and nutrient loss. Sediment-N is the major contributor to nitrogen loss with values up to 4.2 ppm. Nitrite is always negligible, nitrate varies from negligible to 0.43 ppm, ammonia ranges from negligible to 0.61 ppm and organic nitrogen never exceeds 1 ppm. Maximum measured nitrogen loss for any runoff event when adjusted to flow rate was 1.5 kg/ha on July 11, 1976 from the continuously, heavily grazed pasture in poor condition. Other nutrients evaluated also had low concentrations in runoff waters. Soils have total nitrogen contents that range between 0.3 and 1.0 %. Total nitrogen is high, but exchangeable nitrogen is low. Ammonia nitrogen is the dominant form of exchangeable nitrogen and most values fall between 0.5 and 5.0 ppm. Exchangeable soil nitrogen available for movement into surface runoff water is low and does not present a major quality problem. Infiltration and sediment production studies indicate that overall these rangelands have high infiltration rates and even those in poor condition have relatively low sediment losses. Grazing management can increase infiltration and reduce runoff and sediment losses. W77-09266

WATER RESOURCE AND LAND USE PROBLEMS IN WESTERN AUSTRALIA.

Perth Public Works Dept. (Australia). Planning Design and Investigation Branch. B. S. Sadler.

In: Watershed Management on Range and Forest Lands, Proceedings of the Fifth Workshop of the U.S./Australia Rangelands Panel, Boise, Idaho, June 15-22, 1975. p 13-30. Published in March 1976. 8 fig, 4 ref.

Descriptors: *Water resources, *Australia, *Water resources development, *Land use, *Water utilization, Watershed management, Salinity, Planning, Research and development, Land management, Forest management, Runoff, Institutional constraints. Identifiers: *Western Australia.

The State of Western Australia, one-third of the Australian continent, varies in climate from subtropical summer monsoons in the north to a winter rainfall temperate climate in the south, with arid or semi-arid climate in the interior. Average annual discharge of the state's rivers is only 14 1/2% of the national figure, and only a fraction of the surface water can be diverted to use. Resource distribution is uneven and unfavorable, 72% being in a region of low population. Short rivers and streams draining southern forests near the Perth Coastal Plain are the major water resources of the region. The main watershed management problem has been erosion and sediment transport caused by overgrazing. The salinity problem is serious. More than 50% of the usable surface water resources have been affected adversely by land use changes from forest to agricultural. Per capita urban water consumption rate is one of the highest in Australia. Control and distribution of water resources is outlined, along with adverse effects of current practices. Land use-water use conflicts relating to agriculture, forestry, mining, utilities and recreational sectors are discussed, along with research and planning requirements. (Jahns-Arizona) W77-09296

LIFE AT THE DESERT'S EDGE.

Mosaic, Vol. 8, No. 1, p 21-27, Jan-Feb. 1977. 4 fig.

Descriptors: *Droughts, *Arid lands, *Africa, *Human population, Grazing, Planning, Political constraints, Range management, Arid climates, Semiarid climates, Weather patterns, Rainfall, Social adjustment, Social impact. Identifiers: *Sahel, *Desertification.

The recent 5-year drought in the African Sahel focused attention on the problems of human populations in the world's arid zones. This disaster had a devastating impact on nomadic herdsman who lost from 20 to 50% of their flocks, and on the farming population. Recurrent droughts are a harsh fact in the Sahel where the latest episode was itself less severe than that in 1910-13. Coupled with the variable climate in a desert ecosystem is the effect of introduced European technology and science which have increased population and consequent pressures on the land. Survival strategies in different portions of the Sahel include grazing in the north and sedentary farming in the south. Other resources to basic survival in this semiarid zone are discussed. There is some fear that pastoralists may be overrunning their resource base, thereby increasing damage possibilities from future droughts. Governmental control has encouraged a shift from a subsistence to a commercial economy in which more animals are produced for sale in distant markets. Impacts of ecological, economic, and political changes on desertification are presented. Possibilities for range management in the context of changing social patterns are also discussed. (Jahns-Arizona) W77-09305

ON THE CAUSES OF LOCAL CLIMATIC ANOMALIES, WITH SPECIAL REFERENCE TO PRECIPITATION IN WASHINGTON STATE.

Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.

For primary bibliographic entry see Field 2B. W77-09355

ENVIRONMENTAL CHANGES IN LAKE ERIE AND THEIR FUTURE IMPACT ON LAKE RESOURCES.

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

For primary bibliographic entry see Field 5C. W77-09454

4D. Watershed Protection

EROSION CAUSED BY INTENSE RAINFALL IN A SMALL CATCHMENT IN NEW YORK STATE.

Clark Univ., Worcester, Mass. Graduate school of Geography.

For primary bibliographic entry see Field 2J. W77-09134

URBANIZATION AND FLOODING - AN EXAMPLE.

Water Resources Engineers, Inc., Springfield, Va. For primary bibliographic entry see Field 4C. W77-09161

MALVERN URBAN TEST CATCHMENT, VOLUME I.

Canada Centre for Inland Water, Burlington (Ontario). J. Marsalek.

Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 57, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, 1977. 55 p, 9 fig, 8 tab, 7 ref, append. 73-3-12.

Descriptors: Basins, *Testing, *Cities, Topography, *Rainfall-runoff relationships, Surface drainage, Surface runoff, Sewers, Concrete pipes, Precipitation(Atmospheric), Storm runoff, Data collections, *Hydrographs, *Canada, *Watersheds(Basins), *Monitoring, Urban hydrology, *Urban runoff. Identifiers: *Malvern, *Burlington, Ontario, *Urban watersheds.

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4D—Watershed Protection

An urban test catchment (Malvern), representing a modern residential development of 58 acres, was established and instrumented in Burlington, Ontario. The catchment topography, land use, hydrological characteristics, storm drainage and instrumentation are described and discussed. A number of precipitation-runoff events were monitored on the catchment in 1973, and some of these events were simulated with the Storm Water Management Model (SWMM) of the U.S. Environmental Protection Agency. A good fit between the simulation runoff hydrographs and the observed hydrographs was obtained. (WATDOC)
W77-09217

PREDICTING SNOW DEPTHS ON A MOUNTAIN WATERSHED,
Colorado State Univ., Fort Collins. Dept. of Fishing and Wildlife Biology.
For primary bibliographic entry see Field 2C.
W77-09257

LAND MANAGEMENT IN THE LAKE ONTARIO BASIN,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 6B.
W77-09275

PREDICTING STORMFLOW AND PEAKFLOW FROM SMALL BASINS IN HUMID AREAS BY THE R-INDEX METHOD,
Georgia Univ., Athens, School of Forest Resources.
For primary bibliographic entry see Field 4A.
W77-09334

SENSITIVITY OF SOME RUNOFF MODELS TO ERRORS IN RAINFALL EXCESS,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2A.
W77-09339

NITRATE DYNAMICS IN FALL CREEK, NEW YORK,
Pennsylvania Univ., Philadelphia. Regional Planning Div.
For primary bibliographic entry see Field 5B.
W77-09431

5. WATER QUALITY MANAGEMENT AND PROTECTION

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM (FINAL ENVIRONMENTAL STATEMENT),
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-09527

5A. Identification Of Pollutants

A METHOD OF CONCENTRATING THE MAJOR IMPURITIES CONTAINED IN ICE BY ION EXCHANGE,
Grenoble-1 Univ. (France). Institut de Geographie Alpine.
For primary bibliographic entry see Field 2C.
W77-09122

PERSISTENCE OF PROPANIL, DCA, AND TCAB IN SOIL AND WATER UNDER FLOODED RICE CULTURE,
Texas Agricultural Experiment Station, College Station.
For primary bibliographic entry see Field 5B.
W77-09128

HERBICIDES FROM CROPPED WATERSHEDS IN STREAM AND ESTUARINE SEDIMENTS IN HAWAII,
Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science.
For primary bibliographic entry see Field 5B.
W77-09129

COLORIMETRIC DETERMINATION OF ZINC VIA RESORCINOL COMPLEX,
Auburn Univ., Ala. Dept. of Chemistry.
C. W. Tzeng.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 375. Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, August 1974, 49 p, 11 tab, 14 fig. OWRT A-036-ALA(1).

Descriptors: Absorption, *Zinc, Oxygenation, Ammonium compounds, *Pollutant identification, *Spectrophotometry, *Colorimetry, Analytical techniques, Reactions, Metals.
Identifiers: Beer's Law, *Resorcinol complex.

A systematic study of the reaction between resorcinol and zinc ion was carried out. The blue color was formed at pH 10; the color forming reaction was reversible. An investigation was undertaken to study the complex spectrophotometrically. Formation of the blue-colored, water soluble complex between resorcinol and zinc was stable to wide temperature variation. The complex shows maximum absorbance at 610 nm where the absorbance by the reagent or the metal is small.
W77-09138

DATA COLLECTION FOR WATER QUALITY MODELING IN THE OCCOQUAN WATERSHED OF VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
T. J. Grizzard, C. W. Randall, and R. C. Hoehn.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 819-823, July 1976, 3 fig, 3 tab, 16 ref.

Descriptors: *Water quality, *Runoff, *Data collections, *Monitoring, *Programs, *Analytical techniques, Sampling, Methodology, Simulation analysis, Hydrologic data, Mathematical models, Equations, Systems analysis, Reservoirs, *Virginia, Forecasting.
Identifiers: *Pollutant washoff theory, Stream stage, *Occoquan watershed (Va).

The Occoquan Watershed Monitoring Lab has established a network of automatic water samplers at locations on tributaries to the Occoquan Reservoir. The large-scale water quality monitoring program has been instituted to provide runoff water quality data in sufficient detail to facilitate calibration of a predictive model using pollutant washoff theory. The sampling program involves the installation of automatic sampling stations, automated chemical analysis of collected samples, and use of the EPA STORET system as a data management tool. The samples are programmed to collect and store sequential discrete samples at increments of rising and falling stream stage during runoff. When combined with concurrent flow data, analysis of such samples allows the generation of pollutant loading graphs. Such loading data are invaluable in the precise calibration of most mathematical models used to simulate pollutant quantities in surface runoff. For calibration, the measured rates of constituent accumulation will be sequentially varied to achieve agreement in loadings between observed and simulated storms. (See also W77-09154) (Bell-Cornell)
W77-09211

EFFECTS OF IMPOUNDMENT ON WATER AND SEDIMENT IN THE ARKANSAS RIVER AT PUEBLO RESERVOIR,
University of Southern Colorado, Pueblo.
For primary bibliographic entry see Field 5B.
W77-09224

AEROSOL OVER THE HIGH PLAINS OF THE UNITED STATES,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
P. V. Hobbs, D. A. Bowdle, and F. Radke.
Available from the National Technical Information Service, Operations Division, Springfield, Virginia 22161. Bureau of Reclamation, Denver, Colorado, Division of Atmospheric Water Resources Management. Research Report XII, February 1977. 148 p, 30 fig, 7 tab, 42 ref. 14 - 06 - D7664.

Descriptors: *Aerosols, *Air pollution effects, Remote sensing, Dusts, *Dust storms, *Great Plains, Cloud seeding, Weather modification, Climatology, Measurement, *Air masses, Weather patterns, Air circulation.
Identifiers: *HIPLEX PROJECT, *High Plains(US), *Aerosol sinks.

As part of the assessment of the potential for increasing precipitation by artificially seeding summer cumulus clouds in the High Plains (the HIPLEX Project), a detailed airborne study is underway of the nature of the aerosol in this region. Results are presented, based on measurements made in the summer of 1975. The patterns of variation of aerosol concentrations within the mixing layer over the High Plains depend on the type of air mass, the proximity of the aerosol sources and sinks, and the size and type of aerosol. Volume and surface area distributions of aerosol, from 0.01 to 100 micro-m in diameter, were distinctly bimodal over a wide range of meteorological conditions. Most of the aerosol surface area was contained in particles between 0.1 and 1.0 micro-m in diameter, and most of the volume in particles from 10-20 micro-m in diameter. Background concentrations of cloud condensation nuclei active between 0.2 and 1.5% supersaturation, and aerosol between 0.1 and 10 micro-m in diameter, varied with air mass age on a synoptic scale. Concentrations of these aerosol were highest in 'aged' air masses and they were lowest near regions of precipitation. Ice nuclei active between -12 and -20C, and aerosol smaller than 0.1 micro-m or larger than 10 micro-m in diameter, varied on the mesoscale (a) near aerosol sources, and (b) near aerosol sinks. Salt particles up to 10 micro-m in diameter were found only in strong southern flows. Deliquescent soil and pollen particles (probably coated with sulfates) were found only in weaker southerly flows and in continental air masses. The concentrations of deliquescent particles appeared to vary on the cumulus scale. High concentrations of ice nuclei and aerosol near 5 micro-m in diameter, as well as high frequencies of detection of deliquescent particles, were observed immediately downwind of a dust storm and in the remnants of a dust storm 24 hours downwind. Particle loadings in the fringes of the dust storm reached values as high as 625 micro-g m⁻³. (Bur Reclam).
W77-09225

THE ENVIRONMENTAL QUALITY MONITORING REPORT.
National Oceanic and Atmospheric Administration, Washington, D.C. Outer Continental Shelf Task Force.
For primary bibliographic entry see Field 5G.
W77-09231

THE EVALUATION OF THE TEST PROCEDURE FOR HAZARDOUS BINARY COMBINATIONS OF MATERIALS IN MARINE TRANSPORTATION,
Coast Guard Academy, New London, Conn.
For primary bibliographic entry see Field 5G.

W77-09236

TRACE METALS IN MANGROVE SEEDLINGS FROM POLLUTED AND UNPOLLUTED BAYS IN PUERTO RICO,

Puerto Rico Nuclear Center, Mayaguez. Marine Ecology Div.
M. D. Banus.
(1975). 22 p, 1 fig, 5 tab, 9 ref.

Descriptors: *Puerto Rico, *Mangrove swamps, *Water pollution, *Environmental effects, *Metals, *Pollutant identification, Wetlands, Bays, Coasts, Seeds.
Identifiers: *Trace metals, Rhizophora mangle.

Red mangroves (*Rhizophora mangle*) propagate by dropping ripe viviparous seedlings into the water surrounding their roots. Nine batches of thirty ripe seedlings, picked from trees in six locations in Puerto Rico where there are increasing amounts of chemical pollution, were analyzed for the trace metals Fe, Mn, Cu, Zn, Ni and Cd. The leafing (top) and rooting (bottom) ends of each seedling were oven-dried and analyzed by wet-ashing and atomic absorption spectrophotometry. The mean concentration of tops and bottoms of the thirty seedlings in each batch and between batches were compared using 't' statistics at the 98% level. The Cu concentration of seedlings from unpolluted areas is 2.5 ppm with no difference between top and bottom. The concentration increases to 5-7 ppm in locations subjected to pollution. The Fe concentration is 12 ppm for bottom and 13-15 ppm for top seedlings from polluted areas. From unpolluted estuarine mangroves, Mn was 10-11 ppm in bottoms and 30 ppm in tops. The top vs. bottom ratio of Mn was 3-4 for all seedlings. Seedlings from an off-shore coral island have 3.7 ppm Mn bottom and 10.3 ppm top. Accurate Zn levels were not possible due to contamination but are estimated to be 20-30 ppm. Pb, Cd and Ni were below detection limits. Florida red mangrove seedlings have much higher levels of Cu (2X), Fe (10X) and Zn (500X). (Sinha-OEIS)
W77-09240

A CHEMICAL MONITORING PROGRAM OF THE EXPLOSION PRODUCTS IN UNDERWATER EXPLOSION TESTS,

Naval Surface Weapons Center, White Oak Lab., Silver Spring, Md.
For primary bibliographic entry see Field 5G.
W77-09242

MAY 1974 BASELINE INVESTIGATION OF DEEPWATER DUMPSITE 106.

National Oceanic and Atmospheric Administration, Washington, D.C.; and Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5B.
W77-09243

PHYSICAL OCEANOGRAPHY HISTORICAL DATA FOR DEEPWATER DUMPSITE 106,

National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group.
For primary bibliographic entry see Field 5B.
W77-09248

PHYSICAL OCEANOGRAPHIC OBSERVATIONS AT DEEPWATER DUMPSITE 106 - MAY 1974.

National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group.
For primary bibliographic entry see Field 5B.
W77-09249

MICRONUTRIENT ANALYSIS OF SEAWATER SAMPLES TAKEN AT DEEPWATER DUMPSITE 106—MAY 1974,

National Marine Fisheries Service, Narragansett, R.I. MARMAP Field Group.

H. Petersen.

In: NOAA Dumpsite Evaluation Report 75-1, p 189-201, December 1975. 1 tab.

Descriptors: *Nutrients, *Water sampling, *Waste disposal, *Baseline studies, Water resources, *Pollutant identification, Sampling, Monitoring, Sea water, Water analysis.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites, *Sea water analysis, *Micronutrient analysis.

Seawater samples were collected at Deepwater Dumpsite 106 by the NOAA vessel Albatross IV during May 10-23, 1974. Samples were collected and stored aboard. Samples were obtained without filtration from STD (salinity-temperature-density) and hydrographic casts and stored in 250-ml screwcap polycarbonate and polypropylene bottles in the vessel's freezer. Upon completion of the cruise, samples were transferred to a shoreside freezer and maintained at -20C except for analysis. Repeat analyses of several samples confirmed suspicions that some of the micronutrient concentrations vary with time. These results indicate the need to complete analyses in a real-time frame if at all possible when using unfiltered samples. (See also W77-09243) (Sinha-OEIS)
W77-09250

ANALYTICAL RESULTS FOR WATER-COLUMN SAMPLES COLLECTED AT DEEPWATER DUMPSITE 106—MAY 1974,

Environmental Protection Agency, Edison, N.J. Technical Support Group.
F. T. Brezenski.
In: NOAA Dumpsite Evaluation Report 75-1, p 203-215, December 1975. 3 tab.

Descriptors: *Baseline studies, *Waste disposal, *Heavy metals, *Bacteria, *Water sampling, *Water analysis, *Pollutant identification, Analytical techniques.
Identifiers: *Outer Continental Shelf, *Ocean dumping, Dumpsites.

The NOAA vessel Albatross IV collected water-column samples at 23 stations during the May 1974 survey of Deepwater Dumpsite 106. These samples were analyzed for total coliform bacteria, fecal coliform bacteria, heterotrophic marine bacteria, total Kjeldahl nitrogen (TKN), nitrate-nitrogen, total phosphorus, mercury, cadmium, zinc, copper, manganese, and lead. Methodology for developing the data and the results obtained are presented. (See also W77-09243) (Sinha-OEIS)
W77-09251

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 1.

Office of Water Research and Technology, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 427. Price codes: A19 in paper copy, A01 in microfiche. Water Resources Scientific Information Center, Report OWRT/WSRIC 77-201, May 1977. 438 p.

Descriptors: *Heavy metals, *Bibliographies, *Pollutant identification, *Analytical techniques, Cadmium, Chromium, Cobalt, Copper, *Industrial wastes, Iron, Lead, Manganese, Molybdenum, Nickel, Toxicity, Trace elements, Waste water treatment, Zinc.

This report, containing 499 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. (See also W77-09260 thru W77-09263)
W77-09259

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 2.
Office of Water Research and Technology, Washington, D.C.
Water Resources Scientific Information Center, Report OWRT/WSRIC 77-205, May 1977. 479 p.

Descriptors: *Heavy metals, *Bibliographies, *Pollutant identification, *Analytical techniques, Cadmium, Chromium, Cobalt, Copper, *Industrial wastes, Iron, Lead, Manganese, Molybdenum, Nickel, Toxicity, Trace elements, Waste water treatment, Zinc.

This report, containing 500 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. (See also W77-09259)
W77-09260

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 3.

Office of Water Research and Technology, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 429. Price codes: A17 in paper copy, A01 in microfiche. Water Resources Scientific Information Center, Report OWRT/WSRIC 77-206, May 1977. 371 p.

Descriptors: *Heavy metals, *Bibliographies, *Pollutant identification, *Analytical techniques, Cadmium, Chromium, Cobalt, Copper, *Industrial wastes, Iron, Lead, Manganese, Molybdenum, Nickel, Toxicity, Trace elements, Waste water treatment, Zinc.

This report, containing 419 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. (See also W77-09259)
W77-09261

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 4.

Office of Water Research and Technology, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 430. Price codes: A12 in paper copy, A01 in microfiche. Water Resources Scientific Information Center, Report OWRT/WSRIC 77-207, May 1977. 351 p.

Descriptors: *Heavy metals, *Bibliographies, *Pollutant identification, *Analytical techniques, Cadmium, Chromium, Cobalt, Copper, *Industrial wastes, Iron, Lead, Manganese, Molybdenum, Nickel, Toxicity, Trace elements, Waste water treatment, Zinc.

This report, containing 430 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. (See also W77-09259.)
W77-09262

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 5.

Office of Water Research and Technology, Washington, D.C.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 431. Price codes: A16 in paper copy, A01 in microfiche. Water Resources Scientific Information Center, Report OWRT/WRISC 77-208, May 1977. 361 p.

Descriptors: *Heavy metals, *Bibliographies, *Pollutant identification, *Analytical techniques, Cadmium, Chromium, Cobalt, Copper, *Industrial wastes, Iron, Lead, Manganese, Molybdenum, Nickel, Toxicity, Trace elements, Waste water treatment, Zinc.

This report, containing 419 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. (See also W77-09259.) W77-09263

RESPONSE OF THE SPOKANE RIVER DIATOM COMMUNITY TO PRIMARY SEWAGE EFFLUENT, Eastern Washington State Coll., Cheney. Dept. of Biology. For primary bibliographic entry see Field 5C. W77-09273

AMMONIA TRANSPORT IN WATER SATURATED POLYMERIC FILMS, Missouri Univ.-Kansas City. Dept. of Chemistry. M. L. Smith. Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 629. Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1973. 102 p, 21 fig, 19 tab, 14 ref. OWRT A-062-MO(2), 14-31-0001-3825.

Descriptors: Permeability, *Ammonia, Membranes, Ion exchange, Pollutant identification, Analytical techniques, Path of pollutants, Polymers, Waste water treatment, Computer program, Measurement, Films, Rubber, Industrial wastes. Identifiers: *Ammonia in wastewater.

A technique was developed to measure the NH₃ diffusivity in aqueous systems. A study was made of NH₃ transport in water-saturated silicone rubber, mylar, saran, polyethylene and 'Parafilm'. The study includes a derivation of a theoretical model of the electrode and a set of computer programs written to solve and plot the complex equations which are derived as the solution. A comparison was made of the experimental data with the shape of the theoretical curves to establish the validity of the technique employed to calculate diffusion coefficients. Agreement was satisfactory for sorption/desorption model, but seems less satisfactory for a diffusion cell technique. Results for all films studied showed that the diffusion coefficients are of the order of 10⁻⁷ to 10⁻⁸. Films containing many polar or hydrogen bonding sites (silicone rubber, mylar) exhibit the highest diffusivity, while aliphatic materials (Saran, polyethylene, 'Parafilm') showed lower diffusivity and solubility of NH₃. W77-09274

EFFECT OF PH AND COMPLEX FORMATION ON MERCURY (II) ADSORPTION BY BENTONITE, Kansas State Univ., Manhattan. Dept. of Agronomy. For primary bibliographic entry see Field 2G. W77-09281

BEHAVIOR OF CHROMIUM IN SOILS: II. HEXAVALENT FORMS, Vermont Univ., Burlington. Dept. of Plant and Soil Science.

For primary bibliographic entry see Field 2G. W77-09283

EFFECT OF DISSOLVED OXYGEN ON REDOX POTENTIAL AND NITRATE REMOVAL IN FLOODED SWAMP, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab. For primary bibliographic entry see Field 5C. W77-09286

POTASSIUM STATUS OF SOME ALLUVIAL SOILS IN KENTUCKY, Kentucky Univ., Lexington. Dept. of Agronomy. For primary bibliographic entry see Field 2G. W77-09290

CORRECTION OF 'TUBE CONTRIBUTION' INTERFERENCE IN THE DETERMINATION OF HEAVY METALS BY X-RAY SPECTROSCOPY USING THE 'ADDITIONS TECHNIQUE', Maryland Agricultural Experiment Station, College Park. Dept. of Soil Science. V. Z. Keramidas, and D. S. Fanning. Soil Science Society of America Journal, Vol. 40, No. 6, p 857-860, November-December 1976. 2 fig, 1 tab, 7 ref.

Descriptors: *Heavy metals, Zinc, Copper, Nickel, Soil chemistry, Soil properties, Soil investigations, *X-ray spectroscopy, *Pollutant identification, Analytical techniques. Identifiers: Heavy metal determination.

Cr and W X-ray tubes emitted not only the target characteristic lines but the lines of Fe, Zn, Cu, and Ni as well. Such extraneous radiation, which probably originates primarily from contamination of the tube target by the metals and is referred to as 'tube contribution,' may lead to erroneous qualitative interpretation of X-ray spectra because peaks of the elements may appear in the spectra when the element is not present in the sample. The additions (or spiking) technique allows matrix problems to be overcome in the quantitative measurement of Zn, Cu, and Ni in soils and other materials, but an accurate estimation of the background under the peak is essential. (Skogerboe-Colorado State) W77-09292

A SEMIAUTOMATED PROCEDURE FOR TOTAL NITROGEN IN PLANT AND SOIL SAMPLES, Florida Univ., Gainesville. Dept. of Agronomy. For primary bibliographic entry see Field 2K. W77-09294

STUDY OF MERCURY INTOXICATION IN A TELEOST FISH, ANGUILLA ANGUILLA: I. ACCUMULATION OF MERCURY IN THE ORGANS, (IN FRENCH), Liege Univ. (Belgium). Laboratoire de Biologie Generale. For primary bibliographic entry see Field 5C. W77-09320

STUDY OF MERCURY INTOXICATION IN A TELEOST FISH, ANGUILLA ANGUILLA: II. EFFECT ON THE REGULATION OF OSMOLARITY, (IN FRENCH), Liege Univ. (Belgium). Laboratoire de Biologie Generale. For primary bibliographic entry see Field 5C. W77-09321

DISTRIBUTION OF NUTRIENTS IN LOUISIANA'S COASTAL WATERS INFLUENCED BY THE MISSISSIPPI RIVER, Louisiana State Univ., Baton Rouge. Dept. of Marine Science; and Louisiana Wildlife and Fisheries Commission, Baton Rouge. Seafood Div.

For primary bibliographic entry see Field 5B. W77-09323

A BIOLOGICAL AND CHEMICAL COMPARISON OF VARIOUS AREAS OF A RESERVOIR, Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies. For primary bibliographic entry see Field 5C. W77-09342

OXYGEN CONSUMPTION BY FRESHWATER SEDIMENTS, Clemson Univ., S.C. Dept. of Environmental Systems Engineering; and Clemson Univ., S.C. Dept. of Microbiology. For primary bibliographic entry see Field 5C. W77-09348

PRECIPITATION LOADING OF ACID AND HEAVY METALS TO A SMALL ACID LAKE NEAR SUDBURY (ONTARIO), Fisheries and Marine Service, Nanaimo (British Columbia). Biological Station. R. J. Beamish, and J. C. Van Loon. Journal of the Fisheries Research Board of Canada, Vol. 34, No. 5, p 649-658, May 1977. 4 fig, 7 tab, 14 ref.

Descriptors: *Lakes, *Acids, Precipitation (Atmospheric), *Canada, Hydrogen ion concentration, Water pollution, Water pollution sources, *Heavy metals, Air pollution, Sampling, On-site investigations, Acidic water, Runoff, Watersheds (Basins), Pollutants, Sulfates, Manganese, Zinc, Nickel, Lake sediments, *Pollutant identification, *Air pollution effects. Identifiers: *Acid lakes, *Acid precipitation, *Lumsden Lake (Ontario).

The pH of Lumsden Lake was closely related to the measured amount of acid entering the lake from bulk precipitation. In 1972 it was estimated that an excess of 2135 kg of H₂SO₄ was added to the lake from the atmosphere. The predicted annual change in lake pH was from 5.2 to 4.8, and the actual measured change was from 5.2 to 4.7. In 1973 an estimated excess of 1271 kg of H₂SO₄ was added to the lake from the atmosphere. The predicted annual pH change was from 4.8 to 4.7, and there was no net change in the lake pH in 1973. Lumsden Lake also had high concentrations of sulfate, manganese, zinc, and nickel in comparison with remote or 'unpolluted' lakes. High concentrations of manganese and possibly some zinc in the lake appeared to result from increased mobilization from the lake sediments or watershed or both as the pH decreased. Atmospheric fallout also contributed substantial quantities of nickel and copper to the watershed, some of which appeared to be retained in the lake water. The high concentrations of lead in the precipitation were not retained in the lake. (Sims-ISWS) W77-09353

DISSOLVED AMINO ACIDS IN THE EQUATORIAL PACIFIC, THE SARGASSO SEA, AND BISCAYNE BAY, Scripps Institution of Oceanography, La Jolla, Calif. C. Lee, and J. L. Bada. Limnology and Oceanography, Vol. 22, No. 3, p 502-510, May 1977. 4 fig, 2 tab, 35 ref. NSF GA-40804, GB-25121.

Descriptors: *Amino acids, *Sea water, *Oceans, *Pacific Ocean, Sampling, Chemical analysis, Analytical techniques, Marine biology, Bacteria, Marine bacteria, Organic acids, Peptides, Proteins, Algae, Biology, Oceanography, Pollutant identification, Water pollution sources. Identifiers: *Biscayne Bay, *Sargasso Sea.

Seawater samples from several depths in the Sargasso Sea and equatorial Pacific and from surface stations in Biscayne Bay were analyzed for dissolved free amino acids and for dissolved combined amino acids by a ligand-exchange chromatography technique. Enantiomeric ratios of dissolved total amino acids from Atlantic and Pacific samples also were determined. On the basis of the ratios, a bacterial source was postulated for the origin of the dissolved D-amino acids in seawater. The possible contributions from chemical racemization were compared to biological production as a source for these D-amino acids. (Sims-ISWS)

W77-09356

A THERMAL CONTROLLER FOR THE SHORT COD DETERMINATION

Agricultural Research and Education Center, Lake Alfred, Fla.
P. G. Crandall, C. C. Niemietowski, and P. E. Nelson.

Journal of Food Science, Vol 42, No 3, p 839-842, May-June, 1977. 1 fig, 3 tab, 12 ref.

Descriptors: *Chemical oxygen demand, Analysis, *Automatic control, *Temperature control, *Industrial wastes, Equipment, Performance, Corn(Field), Tomatoes, Biochemical oxygen demand, Instrumentation, Waste water treatment, Pollutant identification.
Identifiers: *Food processing wastes, COD determination.

A thermal controller was developed which can be used for food processing wastes to improve the short COD analysis method. It has made the process faster, safer, and more precise due to automatic temperature and agitation control. This process modification minimized sample loss by eliminating sample transfer from the heating flask to another for titration. Errors from excessive sample dilution were also avoided. Equipment costs nearly equaled that of the BOD and long COD methods. There was a 25-50% saving in time and chemicals over the longer COD method. Fluctuations in line voltage did not affect controller stability; solid state switching reduced wear. Safety was improved because it is not necessary to handle hot flasks or acids. The researcher could be protected from caustic fumes and accidental splattering by a hood with a sliding glass front. The need of a degree of technical competence was one disadvantage of this system. Lengthy titration periods were not reduced. The precision of results was shown by the analysis of corn and tomato processing wastes. Glucose solutions were found to have a coefficient of variation of 1.4%, rather than 20% (BOD method) or 8% (long COD method). Tomato waste coefficient of variation was 2.7%, and more reproducible results were obtained for the corn waste samples. (Collins-FIRL)

W77-09415

CHEMICAL REDUCTION OF NITRATE BY FERROUS IRON

North Dakota State Univ., Fargo. Dept. of Soils.
R. J. Buresh, and J. T. Moraghan.
Journal of Environmental Quality, Vol. 5, No. 3, p 320-325, July-September 1976. 5 fig, 4 tab, 30 ref.

Descriptors: *Nitrates, *Denitrification, *Nitrogen, Chemical reactions, Chemicals, Iron, Air pollution, Pollutant identification.

Knowledge concerning the chemical reduction of NO_3^- to gaseous products, a process of potential practical significance as an antipollution device, is sparse. The influence of pH on chemical reduction of NO_3^- -N (approximate concentration 23 ppm) by Fe^{2+} in the presence and absence of Cu^{2+} was studied over a pH range from 6 to 10. After 24-hours of controlled pH incubations under a helium atmosphere NO_3^- , N_2O , N_2 , and NH_4^+ were determined. The initial $\text{Fe}^{2+}/\text{NO}_3^-$ mole ratio was 8. Reduction of NO_3^- was negligible in

the absence of Cu^{2+} , but was pronounced above pH 7 in the presence of approximately 5 ppm Cu^{2+} . Formation of NH_4^+ increased with pH and was the dominant process at pH 9 and 10. Nitrous oxide and N_2 accumulations were greatest in the pH range from 8 to 8.5 and negligible at pH 6 and 10. Nitrite formation was small except at pH 9 and 10. Trace quantities of NO accumulated during incubation if the pH was allowed to drop below 6. Levels of Cu^{2+} and Fe^{2+} influenced the extent and nature of NO_3^- reduction at pH 8. Maximum reduction of NO_3^- (93%) and maximum gas production, equivalent to 61% of the original NO_3^- , occurred when the $\text{Fe}^{2+}/\text{NO}_3^-$ mole ratio was 12 and the Cu^{2+} level was approximately 10 ppm. The $\text{N}_2\text{O}/\text{N}_2$ mole ratio in the evolved gases decreased as the Cu^{2+} level was increased from approximately 1 to 10 ppm and as the $\text{Fe}^{2+}/\text{NO}_3^-$ mole ratio was increased from 8 to 12. Nitrate was relatively stable at a Cu^{2+} content of 0.1 ppm irrespective of the $\text{Fe}^{2+}/\text{NO}_3^-$ ratio. (Skogerboe-Colorado State)

W77-09426

PSEUDOMONAS AERUGINOSA-FECAL COLIFORM RELATIONSHIPS IN ESTUARINE AND FRESH RECREATIONAL WATERS

National Marine Water Quality Lab., West Kingston, R.I.
V. J. Cabelli, H. Kennedy, and M. A. Levin.

Journal Water Pollution Control Federation, Vol 48, No 2, p 367-376, 1976. 5 fig, 3 tab, 17 ref.

Descriptors: *Beaches, *Pseudomonas, *Coliforms, *Water quality standards, Public health, Pathogenic bacteria, Diseases, *Bioindicators, Swimming, Regression analysis, Water sports, Pollutant identification.
Identifiers: *Pseudomonas aeruginosa.

The validity of total coliform densities as an index of fecal pollution is questioned as there is no conclusive evidence correlating fecal coliform densities to enteric diseases in swimmers. It is suggested that *Pseudomonas aeruginosa* has advantages over coliforms as a fecal pollution indicator because it is primarily associated with human feces and has better survival characteristics than the coliform groups. In a Rhode Island study of estuarine and freshwater to determine the relationship of *P. aeruginosa* densities to fecal coliform levels at varying distances from known pollution sources, the ratios of *P. aeruginosa*:fecal coliform densities $\times 100$ (PA:FC) were greatest at those stations furthest from the pollution sources. PA:FC ratios of less than 2.5 were associated with immediate pollution sources with the exception at one station where a high FC density was accompanied by a relatively high PA level, suggesting that the source of the organisms was not sanitary wastes and that the FC were not of fecal origin but rather associated with some other source. It is proposed that *P. aeruginosa* determinations, when used in conjunction with the assay of fecal coliforms or some other indicator organisms, could be valuable in developing standards for recreational waters and as a means of detecting low pollution levels arising from distant origins. (Auen-Wisconsin)

W77-09474

SURVEY OF INDUSTRIAL PROCESSING DATA. TASK I-HEXACHLOROBENZENE AND HEXACHLOROBUTADIENE POLLUTION FROM CHLOROCARBON PROCESSING

Midwest Research Inst., Kansas City, Mo.
For primary bibliographic entry see Field 5B.

W77-09475

MINERALOGICAL COMPOSITION OF SUBMERGED AQUATIC MACROPHYTES FROM CONNECTICUT

U. M. Cowgill.
Verhandlungen Internationale Vereinigung Limnologie Vol 19, p. 2749-2757, 1975. 7 fig., 13 ref.

Descriptors: *Aquatic plants, *Mineralogy, Submerged plants, *Connecticut, Calcium compounds, Silica, Oxides, Quartz, X-ray analysis, Pollutant identification.

Identifiers: *Mineral properties, Ceratophyllum demersum, Potamogeton praelongus, Potamogeton crispus, *Linsley Pond(Conn).

Mineral properties of submerged aquatic plants (*Ceratophyllum demersum*, *Potamogeton crispus*, and *P. praelongus*) in Linsley Pond, Connecticut, were determined by X-ray diffraction and their functions and uptake mechanisms were studied. Whewellite, calcium oxalate monohydrate, the dihydrate form of weddellite, calcium a low-cristobalite-tridymite opal, and very small amounts of quartz and hematite were found. Calcium carbonate is commonly found in a variety of plant tissues and is believed to be an extracellular substance. There is no general agreement as to the genesis or function of calcite production by plants. Younger plants in this study contained more calcite than older plants. The chemical nature of silica in higher plants has been identified as opal and quartz—one classified as a diatom type and the other identified as a low-cristobalite-tridymite type. The analyses showed structures resembling both low-cristobalite and low tridymite. Neither their genesis nor their function is apparent. Both weddellite and whewellite, in varying quantities, were present in both species, though *Potamogeton* contained lesser quantities. There was no striking difference in the amount of the low-cristobalite-tridymite opal with age of the plants. It is assumed that this type of opal is external to the plant. The data suggest that these compounds are a method of removing unwanted calcium of oxalic acid from tissues, or possibly a means of adjusting to a polluted environment. (Auen-Wisconsin)

W77-09477

NITROGEN FIXATION IN AQUATIC ENVIRONMENTS—A CRITICAL STUDY OF ACETYLENE REDUCTION ASSAY

R. J. Flett, R. D. Hamilton, and N. E. R. Campbell.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 2664-2668, 1975. 3 fig, 6 ref.

Descriptors: *Nitrogen fixation, Analytical techniques, *Assay, Measurement, Laboratory tests, Methodology, Bioassay, Pollutant identification.
Identifiers: *Acetylene reduction assay.

Some solutions are proposed for the lack of sensitivity of the currently-used acetylene reduction assay to determine nitrogen fixation in water. The present method assumes that ethylene is insoluble in water and therefore that all the ethylene produced is quickly transferred to the vapor phase. This assumption is incorrect as ethylene is quite soluble and the amount of ethylene that passes into the vapor phase is an equilibrated closed system depends upon the relative amounts of aqueous and vapor phase present. Assay sensitivity can be easily enhanced by increasing the relative proportion of aqueous phase in the incubation vessel rather than by concentrating the sample, and achieving equilibrium. A method proposed employs a London Luer 50 ml glass syringe as an incubation vessel, used as follows: A quantity of water is drawn into the syringe and appropriate amount of acetylene is injected above the sample. With the syringe sealed, agitation causes the acetylene to almost completely (ca. 95%) dissolve; essentially no vapor phase remains. After incubation, an appropriate quantity of air can be drawn in, the syringe sealed and agitated for a predetermined period. The equilibrated vapor phase can then be injected into a suitable serum stoppered storage vessel for later analysis. (Auen-Wisconsin)

W77-09490

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

AQUATIC BASELINE SURVEY OF SELECTED TEST AREAS ON EGLIN AIR FORCE BASE RESERVATION, FLORIDA.
Air Force Armament Lab., Eglin AFB, Fla.
For primary bibliographic entry see Field 7C.
W77-09499

ASPECTS OF PHOSPHATE UTILIZATION BY BLUE-GREEN ALGAE.
Herbert H. Lehman Coll., Bronx, N.Y.
For primary bibliographic entry see Field 5C.
W77-09505

EUTROPHICATION POTENTIAL OF DAIRY CATTLE WASTE RUNOFF.
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5C.
W77-09509

PROBLEMS WITH RADIOMETRIC COLIFORM ASSAYS.
Framingham State Coll., Mass. Dept. of Biology.
J. J. Preville, and C. T. Rosdey.
Final Report ARO-12845.1-R-1, April 1976. 23 p, 3 fig, 3 tab, 21 ref. DA HC04-75-G-0045.

Descriptors: *Analytical techniques, *Coliforms, *Radioactivity techniques, *Enteric bacteria, *Pathogenic bacteria, *E. coli*, *Pseudomonas*, *Salmonella*, Assay, Carbon radioisotopes, *Bioassay, *Pollutant identification.
Identifiers: *Radiometric coliform assays.

In research aimed at determining feasibility of adaptation of conventional media for coliform assays to rapid radiometric techniques, lack of specificity when using carbon radioisotopes in detecting coliform bacteria was investigated with Lauryl Triptose, British MacConkey, m-Endo-MF, Nutrient and Brilliant Green Bible broth media. The radioactive substrates included 1-14C lactose, 1-6 14C glucose and 14C formate. The time needed to detect a significant level of carbon dioxide-14 with a Bactec model 301 varied inversely with the logarithm of the inoculum of several coliform species. When several strains of *Escherichia coli* were studied individually in addition to strains of *Enterobacter agglomerans*, *Pseudomonas aeruginosa*, *Proteus* *inconstans*, *P. morganii*, and *Salmonella* St. Paul, noncoliform species produced carbon dioxide-14 in the media. Production of carbon dioxide-14 by non-coliforms was related to the contamination of the 14C substrate. Contamination was verified by paper chromatography of the 14C lactose solutions followed by washing out of designated loci for lactose and glucose. Scintillation counter analysis showed that 7.6% of the radioactivity was present as 14C glucose. The coliforms and non-coliforms produced carbon dioxide-14 within 24 hours or less in all media. None of the species produced dioxide-14, including *E. coli* and *Enterobacter agglomerans*, during incubation at 42C in Korsh's medium. All six species produced carbon dioxide-14 in less than 24 hours after re-inoculation with 0.1 ml of the respective cultures and incubation at 35C. (Auen-Wisconsin)
W77-09514

CLEAN AIR EQUALS DIRTY WATER.
Los Angeles Dept. of Public Works, Calif.
For primary bibliographic entry see Field 5G.
W77-09544

AN AUTOMATIC SYSTEM FOR RAPID DETECTION OF ACUTE HIGH CONCENTRATIONS OF TOXIC SUBSTANCES IN SURFACE WATER USING TROUT.
Netherlands Waterworks, Rijswijk. Testing and Research Inst.
C. L. M. Poels.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K. L.

Dickson and G. F. Westlake, Eds., American Society for Testing and Materials, 1977, p. 85-95. 3 fig., 11 ref.

Descriptors: *Monitoring, *Analytical techniques, *Toxins, *Trout, *Water quality control, *Bioindicators, *Fish behavior, Surface waters, Design, *Electrical equipment, Water pollution effects, Fish physiology.
Identifiers: *Continuous biological monitoring systems, Flow through systems, Warning system, Rheotactic response.

Trout normally possess a positive rheotactic behavior, and this behavior is often lost in response to toxic conditions. A continuous automated monitoring system was developed incorporating photoelectric cells and mild electric shock. When a trout no longer displayed positive rheotaxis and moved downstream in the test tank, a series of photoelectric cells were interrupted. This, in turn, caused a mild electric shock to be applied to the downstream portion of the test tank. This electric irritation continued until the fish moved back upstream away from the photocells. A second series of photoelectric cells indicate when the fish remain in the downstream area regardless of the applied electrical impulse. An alarm switch will operate when at least two of the three fish in the same 15-min period pass the photoelectric cells more often than normal or when two fish remain in the extreme downstream portion of the monitoring tank for longer than 5 min. Practical experiences on Rhine water and experiments with toxic substances suggest that this flow-through system is suited for practical application. (Katz)
W77-09590

THE IMPORTANCE OF MONITORING CHANGE.
Academy of Natural Sciences of Philadelphia, Pa.
R. Patrick.
In: Biological Monitoring of Water and Effluent Quality, ASTM STP 607, J. Cairns, Jr., K.L. Dickson and G.F. Westlake, Eds., American Society for Testing and Materials, 1977, p. 157-189. 1 tab, 28 fig.

Descriptors: *On-site data collections, *Monitoring, *Pollutant identification, Water quality control, *Biological communities, Rivers, Water quality, Fish, *Methodology, *Invertebrates, *Ecological distribution, Water pollution effects, Analytical techniques, Algae, Benthos, Farm wastes, Estuaries, Environmental effects, Ecosystems, *Dams, Georgia, Texas.
Identifiers: *Savannah River(Georgia), *Sabine River(Texas), *Species diversity, *Long-term monitoring.

This paper demonstrates how 25 years of more-or-less continuous monitoring of the Savannah River and of the Sabine River is able to show the effects of man's use of the river over time. The kinds of perturbation which are evident by such monitoring are the building of dams, the increase in organic pollution, and the effects of small amounts of toxic pollution. It demonstrates how this type of monitoring with stations located in various parts of the river can indicate the origin of pollution loads. Monitoring that is carried out continuously by the use of diatometers and intermittently by the study of major groups of organisms living in a river or estuary produces the best combination of facts concerning river conditions and water quality. (Katz)
W77-09591

SOME DISSENTING REMARKS ON "DELETERIOUS EFFECTS OF COREXIT 9527 ON FERTILIZATION AND DEVELOPMENT".
Exxon Research and Engineering Co., Florham Park, N.J.
For primary bibliographic entry see Field 5C.
W77-09593

METALS IN THE AQUEOUS EFFLUENTS FROM MUNICIPAL INCINERATORS AND AN INCINERATOR-RESIDUE PROCESSING PLANT.
Maryland Univ., College Park.
S. L. Law.
Ph.D. Thesis, 1976. 212 p.

Descriptors: *Analysis, *Incineration, *Metals, *Heavy metals, *Waste water treatment, Sewage treatment, Analytical techniques, Neutron activation analysis, Hydrogen ion concentration, Temperature, Cadmium, Lead, Zinc, Manganese, Plastics, Biological treatment, Municipal wastes, Pilot plant, Fuels.
Identifiers: Alexandria(Va), Incinerator-residue processing, Atomic absorption, Wet chemical analysis.

Dissolved and undissolved metals content was determined in the water systems of three incinerators and an incinerator-residue processing pilot plant. Techniques used for analysis were atomic absorption, neutron activation, and wet chemical analytical techniques. An Alexandria, Virginia, incinerator using recycled waters was used as a model for determining the maximum pollution potential of the use of municipal wastes as fuel supplements. In this incinerator, zinc concentrations harmful to biological treatment might occur in the recycled spray-chamber water. EPA drinking water standards are exceeded by a few metals in nonrecycled waters, but are continuously exceeded by cadmium, lead, zinc, manganese, and selenium in the recycled spray-chamber water. The effects of pH, CO₃(2-), SO₄(2-), and Cl(-) on total concentrations are estimated and compared with observed concentrations. It was noticed that pH varied with temperature. No specific time or geographic trends were established in the comparison of solids and dissolved metals in the incinerator and pilot plant effluents. The prediction of sources of metals incinerator effluents was thought possible with the use of an enrichment factor based on aluminum concentrations and crustal abundances of elements. Noncombustible components of urban refuse seemed to be a great contributor of several elements to incinerator effluents. Separation of combustibles prior to use as a fuel supplement was suggested. Plastics, cardboard, newspapers, kraft packaging and magazines produced less than half of the total metals in the combustile fraction. (Collins-FIRL)
W77-09600

5B. Sources Of Pollution

THE EFFECT OF LEACHATE FROM WESTERN RED CEDAR, THUJA PLICATA DONN, ON AQUATIC ORGANISMS.
Washington Univ., Seattle. Cooperative Fisheries Unit.
For primary bibliographic entry see Field 5C.
W77-09101

PERSISTENCE OF PROPANIL, DCA, AND TCAB IN SOIL AND WATER UNDER FLOODED RICE CULTURE.
Texas Agricultural Experiment Station, College Station.
L. E. Deuel, Jr., K. W. Brown, F. C. Turner, D. G. Westfall, and J. D. Price.
Journal of Environmental Quality, Vol 6, No 2, p. 127-132, April-June 1977. 6 fig, 3 tab, 14 ref. EPA/S802008.

Descriptors: *Pesticides, *Herbicides, *Irrigation, *Rice, Pollutants, Agricultural chemicals, Analytical techniques, Pesticide residues, Sprays, Leaching, Water pollution, Soil contamination, Water pollution sources, Pollutant identification, Water quality, Agronomy, Soil analysis, Water analysis.
Identifiers: *Propanil, *Pesticide persistence, Biological degradation, Beaumont clay soil.

Field experiments were conducted to determine the residue levels of propanil (3', 4'-dichloropropionanilide), DCA (3, 4'-dichloroaniline), and TCAB (3, 3', 4, 4'-tetrachloroazobenzene) in the flood water and Beaumont clay soil under normal rice (*Oryza sativa* L.) cultivation. Propanil applied as a foliar spray at 3.4 and 6.8 kg/ha 24 hours before flooding was dissipated from the flood water within 24 hours following the flood. The amount of propanil dissipated corresponded to the DCA concentration in the flood water at 24 hours, indicative of biological quantities. Neither propanil nor its metabolites were detected in soil samples collected at 2.5-5.0 cm and 17.5-20.0 cm below the surface 24 hours following the application of the flood water. (Henley-ISWS) W77-09128

HERBICIDES FROM CROPPED WATERSHEDS IN STREAM AND ESTUARINE SEDIMENTS IN HAWAII. Hawaii Univ., Honolulu. Dept. of Agronomy and Soil Science. R. E. Green, K. P. Goswami, M. Mukhtar, and H. Y. Young. *Journal of Environmental Quality*, Vol 6, No 2, p 145-154, April-June 1977. 1 fig, 7 tab, 34 ref. UNIH-SEAGRANT-CR-74-05.

Descriptors: *Pesticides, *Herbicides, *Agricultural chemicals, *Pollutants, *Water quality, *Hawaii, Water pollution, Soil contamination, Agronomy, Soil analysis, Sugarcane, Sediments, Degradation(Decomposition), Runoff, Phytoplankton, Marine biology, Analytical techniques, Path of pollutants. **Identifiers:** *Herbicide degradation, *Pesticide persistence, Atrazine, Ametryn, Diuron, Organochlorine, Dissipation, Stream sediments, Estuarine sediments, Cropped watersheds, Dip irrigations.

Analysis of sediments and soils associated with two estuaries on Oahu was conducted to determine if herbicides used in plantation crops reach coastal waters. Analytical procedures were developed for simultaneous extraction of atrazine, ametryn, diuron, and DCA. Field soil and runoff samples from two small monitored watersheds provided additional information on the dissipation of diuron in sugarcane and pineapple fields, and on diuron removal in runoff waters. Atrazine and ametryn dissipated rapidly in field soils, and neither was found normally in stream and estuarine sediments. Diuron, on the other hand, was sufficiently persistent in soils and sediments to be found in nearly all sediment samples obtained at 6-month intervals at several sites for each estuary and its associated streams. Diuron in sediments was generally less than 500 ppb (oven-dry basis), but occasionally much higher concentrations were encountered at sites which were subject to localized contamination from spray equipment loading areas. Diuron appears to be transported in runoff waters principally in the solution phase rather than adsorbed on suspended solids. Estuarine waters (West Loch) contained 0.1 to 1 ppb diuron, while concentrations in runoff waters were several times higher. It is not known if the chronic low levels adversely affect the ecological balance of the estuary. (Henley-ISWS) W77-09129

PHOSPHATE AND TRIPOLYPHOSPHATE ADSORPTION BY CLAY MINERALS AND ESTUARINE SEDIMENTS. Virginia Inst. of Marine Science, Gloucester Point. For primary bibliographic entry see Field 5C. W77-09152

ENVIRONMENTAL MODELING AND SIMULATION, PROCEEDINGS OF THE CONFERENCE ON. Environmental Protection Agency, Washington, D. C. Office of Research and Development.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-237 142. Price codes: A06 in paper copy, A01 in microfiche. Report EPA 600/9-76-016, Held April 19-22, 1976, Cincinnati, Ohio, EPA Office of Monitoring and Technical Support, July 1976. 847 p. Ott, W. R., Ed.

Descriptors: *Environmental engineering, *Mathematical models, *Systems analysis, *Water resources, *Simulation analysis, *Air quality, *Water quality control, Statistical methods, Computers, Sanitary engineering, Civil Engineering, *Economics, Radiation, Management, *Planning. **Identifiers:** Econometrics, Noise, Environmental statistics.

This Conference brings together for the first time all the many varied and diverse environmental topics, where mathematicians, statisticians, operations research specialists, systems analysts, engineers, and others with quantitative backgrounds share a common interest. Mathematics and statistics form the foundation for a commonality of approach among modelers. There is also a commonality of purpose. Most modelers attempt to simulate reality, models share many similarities in terms of applications and uses, and most models are based on or make use of environmental data in some form—particularly monitoring data. The Conference objectives were: 'To perform a state-of-the-art review of predictive modeling and simulation in the environmental decision making process; to share modeling expertise within and across various media; and to examine the adequacy of computer and other resources in the development and use of models.' The task was to create a common language that both modelers and decision makers could readily understand, enabling the modeler to convince more manager to use models in environmental decisions. The papers themselves are the results of considerable and extensive environmental modeling efforts in EPA, State and local governments, universities and private industry in the United States; some papers were contributed by modelers from Canada. The many diverse areas in which mathematical models and simulation have been discussed include air, water, pesticides, solid waste, noise, radiation, health, energy, ecology, planning, management, economics, and others. Out of the 167 papers, more than half deal with water. (Bell-Cornell) (See W77-09155 thru W77-09213) W77-09154

A REVIEW OF EPA'S GREAT LAKES MODELING PROGRAM. Environmental Research Lab.-Duluth, Gross Ile, Mich. Large Lakes Research Station. W. L. Richardson, and N. A. Thomas. In: *Proceedings of the Conference on Environmental Modeling and Simulation*, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 20-25, July 1976. 8 fig, 10 ref.

Descriptors: *Great Lakes, *Mathematical models, *Water pollution control, Pollutants, Water policy, Decision making, Management, Monitoring, Lake Huron, Lake Erie, Computers, Systems analysis. **Identifiers:** Transport models.

The Large Lakes Research Station at Grosse Ile, Michigan, is responsible for implementing the EPA, Office of Research and Development's research program for the Great Lakes. The objective is to be able to describe the transport and fate of pollutants. Mathematical models provide the researcher with the necessary tools for accomplishing this task and, once calibrated and verified, they can be used by water quality managers confronted with making policy decisions. Several levels of modeling research have been initiated which address water quality issues ranging from lake-side to near-shore effects, and from eutrophication to hazardous materials. Concurrent surveillance and experimentation programs are being

conducted for model calibration and verification. An overview of the EPA Great Lakes modeling program is presented including results from some specific models. After discussing Great Lakes Modeling in general, the Lake Huron, Lake Erie, Saginaw Bay, and transport modeling efforts are considered. It is concluded that the structuring and calibrating of a model derives benefits long before a final verified model is obtained. Most of the effort in the modeling process is involved with data reduction. (See also W77-09154) (Bell-Cornell) W77-09157

PLANNING IMPLICATIONS OF DISSOLVED OXYGEN DEPLETION IN THE WILLAMETTE RIVER, OREGON. Geological Survey, Portland, Oregon. D. A. Rickert, W. G. Hines, and S. W. McKenzie. In: *Proceedings of The EPA Conference on Environmental Modeling and Simulation*, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 62-68, July 1976. 8 fig, 2 tab, 7 ref.

Descriptors: *Water pollution control, *Dissolved oxygen, *Planning, *Simulation analysis, *River basins, Mathematical models, Hydrology, Summer, Reservoir storage, Standards, Low-flow augmentation, Systems analysis, Channel morphology, Temperature, Nitrification, *Oregon. **Identifiers:** *Willamette River(Oregon).

Basinwide secondary treatment of municipal and industrial wastewaters has resulted in a dramatic increase of summertime dissolved-oxygen (DO) concentrations in the Willamette River. Rates of carbonaceous decay are very low (0.03 to 0.06/day), and point-source BOD loading now accounts for less than one-third of the satisfied oxygen demand. Nitrification is now the dominant DO sink. DO concentrations met the state standards in all reaches of the Willamette during the low-flow period of 1974. Mathematical modeling shows that low-flow augmentation from storage reservoirs was largely responsible for the standards being met. Future achievement of DO standards will require continued low-flow augmentation in addition to pollution control. Summertime flows above 6000 cu ft/s will be needed even with increased treatment removals of oxygen depleting materials. The greatest immediate incremental improvement in DO can be made through reduction in point-source ammonia loading. The pros and cons of upgrading treatment efficiencies for BOD removal would best be determined after ammonia loadings have been reduced to reasonable levels and the possibility of controlling a benthic-oxygen demand in Portland Harbor has been fully assessed. (See also W77-09154) (Bell-Cornell) W77-09160

URBANIZATION AND FLOODING - AN EXAMPLE. Water Resources Engineers, Inc., Springfield, Va. For primary bibliographic entry see Field 4C. W77-09161

PLANNING MODELS FOR NON-POINT RUNOFF ASSESSMENT. Environmental Protection Agency, Athens, Ga. Ambient Monitoring Section. H. A. True. In: *Proceedings of the Conference on Environmental Modeling and Simulation*, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 74-76, July 1976.

Descriptors: *Water resources, *Planning, *Water quality control, *Computer models, *Runoff, *Simulation analysis, Assessment, Rainfall-runoff relationships, Erosion, Sediment, Probability, Systems analysis, Bodies of water. **Identifiers:** *Non-point runoff.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

The main objective in assessing nonpoint runoff is to estimate constituent loads for some representative time period for a defined drainage area. No absolutely accurate answers appear economically feasible now or in the future, and getting a grip on the many facets of the problem is very difficult. Presented are several computer-based planning models; they are generalized tools designed for initial gross assessments with refinement capabilities for decision making. Major benefits can be derived by using these modeling processes to calculate relative numerical measures of effects resulting from changes in treatment level percentages, land use allocation percentages, population densities, loading rates, and rainfall event intensities. The models are not costly to run and are not excessively complex; all computer programming is in the FORTRAN-4 language. The individual models discussed herein are: (1) 'Urban, Commercial, and Industrial Runoff'; (2) 'Erosion, Sedimentation, and Rural Runoff'; and (3) 'Total Loadings from Point and Non-Point Sources to Waterbodies.' The accuracy of these models is directly related to the quality of the input data supplied by the user. (See also W77-09154) (Bell-Cornell) W77-09162

A MATHEMATICAL MODEL OF DISSOLVED OXYGEN IN THE LOWER CUYAHOGA RIVER,

Cleveland State Univ., Ohio.
A. E. Ramm.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 101-105, July 1976. 3 fig, 3 tab, 7 ref.

Descriptors: *Computer models, *Water quality control, *Dissolved oxygen, *Rivers, *Simulation analysis, Flow, Biochemical oxygen demand, Navigation, Channels, Oxygen sag, Industrial wastes, Municipal wastes, Systems analysis, *Ohio.
Identifiers: Sensitivity analysis, *Lower Cuyahoga River(Ohio).

A computer model was developed to rapidly simulate dissolved oxygen content in the Cuyahoga River under varying conditions of flow and biochemical oxygen demand. The model, which has been used to simulate present and projected dissolved oxygen levels for the navigation channel of the Cuyahoga River, shows that despite the fact that industrial and municipal discharges may be completely eliminated, other factors are significant enough to cause a severe oxygen sag in the navigation channel. (See also W77-09154) (Bell-Cornell) W77-09163

A WATER RESIDUALS INVENTORY FOR NATIONAL POLICY ANALYSIS,

National Academy of Sciences, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-09164

A MULTI-PARAMETER ESTUARY MODEL,

Tetra Tech., Inc., Lafayette, Calif.
M. W. Lorenzen.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 111-114, July 1976. 9 fig, 8 ref. 6 EPA 8-01-1807.

Descriptors: *Water resources development, *Water quality control, *Estuaries, *Harbors, *Computer models, *Simulation analysis, Planning, Rivers, Tides, Evaluation, Dissolved oxygen, Biochemical oxygen demand, Hydrodynamics, Monitoring, Systems analysis, *Washington.
Identifiers: *Grays Harbor(Wash), Sensitivity analysis, Benthic oxygen demand.

To obtain information needed in the development of a water quality plan for Grays Harbor, in Washington State, the mathematical water quality model EXPLORE has been modified for application to the harbor and the lower Chehalis River. This report describes the model selection criteria and the procedures used in applying the model to a tidally-influenced estuary and river. Results show that model calculations and observed data correlate well, confirming that the model is a valuable tool for evaluating the effects of various waste discharge schemes on the quality of a water body and thus for helping to select a plan for managing water resources. The study also indicates that further information about rates of benthic oxygen demand and the oxygen content of incoming seawater would improve the accuracy of the model calculations. (See also W77-09154) (Bell-Cornell) W77-09165

MATHEMATICAL MODEL OF A GREAT LAKES ESTUARY,

Environmental Protection Agency, Chicago, Ill.
C. G. Delos.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 115-119, July 1976. 6 fig, 15 ref.

Descriptors: *Great Lakes, *Estuaries, *Lake Erie, *Water quality control, *Simulation analysis, Rivers, Flow, Thermal pollution, Dissolved oxygen, Hydraulics, Mathematical models, Systems analysis, Velocity, *Ohio.
Identifiers: *Black River estuary(Ohio).

A one-dimensional steady-state finite section estuary model was applied successfully to the lower 11 miles of the Black River in Ohio to simulate water quality behavior. The approach used was necessitated by the fact that water quality in the lower portion of the river is strongly influenced by Lake Erie waters. The one-dimensional estuary model represents a compromise between conventional stream models, which are fundamentally inadequate to simulate this type of system, and multi-dimensional models, which require considerably greater resources in order to be applied successfully. The approach used is likely to be applicable to the lower reaches of nearly all rivers tributary to the Great Lakes. (See also W77-09154) (Bell-Cornell) W77-09166

COST-EFFECTIVE ANALYSIS OF WASTE LOAD ALLOCATIONS,

Environmental Protection Agency, Washington, D.C.
J. Kingscott.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 120-125, July 1976. 8 fig, 1 tab, 10 ref.

Descriptors: *Cost analysis, *Wastewater treatment, *Water pollution control, *Standards, *Streams, Effects, *Simulation analysis, *Dissolved oxygen, Effluents, Streamflow, Investment, Biochemical oxygen demand, Optimization, Equations, Systems analysis.
Identifiers: *Cost effectiveness, *Waste load allocation, *Deterministic models.

This paper considers the relative consequences of some procedures used in the application of deterministic models, particularly in the choice of design conditions and the seasonal application of waste load allocations. It was desired that the analysis be general and applicable to a number of situations and issues. It was also necessary that it address real situations, as opposed to being hypothetical. The resulting analysis considers the costs of advanced waste treatment and the effects in terms of a risk for the violation of dissolved oxygen stream standards. An effluent analysis was undertaken to define an empirical procedure for generating effluent loading factors. The waste treatment costs were considered by combining flow dependent unit processes to form viable treatment systems. Five water quality limited segments were analyzed using historical U.S. Geological Survey streamflow records. Cost-effective curves were generated to define feasible treatment options for nitrogenous and carbonaceous BOD removal. The optimal investment strategy for levels of treatment higher than secondary was then used to study issues related to waste load allocations. (See also W77-09154) (Bell-Cornell) W77-09167

WASTE ALLOCATIONS IN THE BUFFALO (NEW YORK) RIVER BASIN,
Versar, Inc., Springfield, Va.
D. H. Sargent.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 126-128, July 1976. 1 tab, 1 ref.

Descriptors: *River basins, *Water quality control, *Simulation analysis, *Industrial wastes, Hydraulics, Combined sewers, Overflow, Thermal pollution, Computer models, Systems analysis, *New York.
Identifiers: *Buffalo River basin(NY), *Waste load allocation, Plug-flow model, Completely-mixed model.

A water quality simulation model, VERWAQ, was developed for the complex hydraulic and waste load characteristics of the Buffalo River. These characteristics include very low water velocities, oscillating flow, upstream flow, inter-basin transfer of water, many critical conservative and non-conservative water quality parameters, thermal pollution, and important non-point as well as point sources of wastes. The developed and verified model was used to project water quality and to allocate waste loads. Projected water quality data for both the average summer time and critical flow are listed. Results show that the projected water quality at critical flow conditions marginally came within the standards for temperature and dissolved oxygen. However, more stringent waste allocations were recommended for iron. (See also W77-09154) (Bell-Cornell) W77-09168

STREAM MODELING AND WASTE LOAD ALLOCATION,

Indiana State Board of Health, Indianapolis. Div. of Water Pollution Control.
J. Y. Hung, A. Hossain, and T. P. Chang.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 129-132, July 1976. 10 ref.

Descriptors: *Water pollution control, *Streams, *Indiana, *Computer models, Dissolved oxygen, Biochemical oxygen demand, Ammonia, *Simulation analysis, Wastes, Evaluation, Methodology, Climatic data, Standards, Equations, Systems analysis.
Identifiers: *Waste load allocation, Streeter-Phelps equation, Cost effectiveness, Cost minimization.

The Indiana Stream Pollution Control Board conducted an intensive stream modeling program for Indiana's major rivers during the past three years. These stream models were used primarily for the purpose of waste load allocation. This paper describes the stream self-purification system models for BOD, DO and ammonia. In addition to the analysis of model components, problems of evaluating system parameters are examined. The formulation of the waste load allocation

methodology and the issues in allocation implementations are reviewed. Proposed are the cost effectiveness approach and the equity approach. Computer modeling of stream self-purification systems is a useful tool for water quality management, especially in a dynamic program like waste load allocation. However, one must be aware of its limitations which can cause difficulties in model verification. (See also W77-09154) (Bell-Cornell) W77-09169

PATUXENT RIVER BASIN MODEL RATES STUDY

Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.

T. H. Pfeiffer, L. J. Clark, and N. L. Lovelace. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 133-138, 6 fig, 4 ref.

Descriptors: *Water quality control, *Surveys, *Computer models, *Simulation analysis, River basins, Effluents, Treatment facilities, Summer, Waste water treatment, Biochemical oxygen demand, Streams, Systems analysis, *Maryland. Identifiers: *Patuxent River basin(Maryland), *Water quality data.

During the summer seasons of 1973 and 1975, intensive water quality surveys were carried out in the Patuxent River Basin for the purposes of mathematical model calibration and validation. In the summer of 1973, the Patuxent was receiving secondary effluent from eight major municipal treatment plants. No significant industrial waste discharges are present in the Patuxent system. A steady state water quality model was calibrated and validated using the data collected from the 1973 field surveys. During 1975, a major treatment plant was upgraded to include high BOD removal and nitrification; new field surveys were conducted and the model was recalibrated and validated to reflect changes in the instream reaction rates as a result of the changed effluent studies, data results, model application procedures and, perhaps most importantly, how the procedures that were used could be improved. (See also W77-09154) (bell-Cornell) W77-09170

EFFICIENT STORAGE OF URBAN STORM WATER RUNOFF

Environmental Protection Agency, Denver, Colo. For primary bibliographic entry see Field 5D. W77-09171

JOINT USE OF SWMM AND STORM MODELS FOR PLANNING URBAN SEWER SYSTEMS

Clinton Bogert Associates, Fort Lee, N.J. For primary bibliographic entry see Field 5D. W77-09172

SIMULATION OF AGRICULTURAL RUNOFF

Hydrocomp, Inc., Palo Alto, Calif. A. S. Donigian, Jr., and N. H. Crawford. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 151-155, July 1976. 7 fig, 15 ref.

Descriptors: *Watersheds(Basins), *Agricultural runoff, *Simulation analysis, *Water quality, Effects, Management, Computer models, Algorithms, Hydrology, Sediments, Pesticides, Nutrients, Systems analysis.

The Agricultural Runoff Management (ARM) Model described in this paper simulated runoff, snow accumulation and melt, sediment loss, pesticide-soil interactions, and soil nutrient transformations on small agricultural watersheds. The results

of Model testing for simulation of runoff, sediment, and pesticide loss are presented to demonstrate possible uses of the ARM Model as a tool for evaluating the water quality impact of agricultural practices. Testing of the Model has indicated that the hydrology and sediment simulations reasonably represent the observed data while the pesticide simulations can show considerable deviation from recorded values. The effects of tillage operations and management practices need to be further evaluated for hydrology and sediment production. There is a need for further investigation of the processes of pesticide degradation and pesticide-soil interactions. (See also W77-09154) (Bell-Cornell) W77-09173

MODELING THE EFFECT OF PESTICIDE LOADING ON RIVERINE ECOSYSTEMS

Southeast Environmental Research Lab., Athens, Ga.

J. W. Falco, and L. A. Mulkey. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 156-160, July 1976. 5 fig, 2 tab, 14 ref.

Descriptors: *Rivers, Effects, *Pesticides, *Simulation analysis, *Water quality control, *Fish, Computer models, Reach(Streams), Watersheds(Basins), Pollutants, Evaluation Systems analysis, Equations, *Forecasting. Identifiers: *Malathion, *Non-point source problems.

A mathematical model for predicting the fate and transport of malathion in riverine ecosystems has been developed. The model predicts the concentration of malathion down the length of a river reach as a function of time and non-point source loading. Model simulations predict that standing crops of various fish species and other organisms decrease with increasing malathion concentration. Mass die-offs have been predicted at critical malathion loadings and concentrations. (See also W77-09154) (Bell-Cornell) W77-09174

RADIONUCLIDE TRANSPORT IN THE GREAT LAKES

Office of Radiation Programs, Washington, D.C. R. E. Sullivan, and W. H. Ellett.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 161-165, July 1976. 1 fig, 2 tab, 12 ref.

Descriptors: *Water pollution control, *Great Lakes, *Nuclear wastes, United States, Canada, Computer programs, Equations, *Mathematical models, Systems analysis, *Simulation analysis, *Forecasting, Radioisotopes. Identifiers: *Radionuclide levels, Power stations, Dose rates.

A mathematical model has been developed to predict radionuclide levels in the Great Lakes due to nuclear power generation in the United States and Canada. The calculations have been used to verify the feasibility of proposed International water quality objectives for radioactivity in the lakes. Dose rates and doses to reference-man from the ingestion to Lake waters are predicted based on expected future power generation in this region. Results show that by far the largest cumulative dose is due to the concentration of tritium in Lake waters. (See also W77-09154) (Bell-Cornell) W77-09175

FEDBAK03 - A COMPUTER PROGRAM FOR THE MODELLING OF FIRST ORDER CONSECUTIVE REACTIONS WITH FEEDBACK

UNDER A STEADY STATE MULTIDIMENSIONAL NATURAL AQUATIC SYSTEM, Environmental Protection Agency, New York. Data Systems Branch. G. A. Noss.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 166-170, July 1976. 5 fig, 8 ref.

Descriptors: *Computer models, *Computer programs, *Aquatic environment, *Water quality, Kinetics, Dissolved oxygen, Equations, Estuaries, Nitrification, Nitrogen cycle, Systems analysis. Identifiers: Nitrogenous species.

Described is a computer model used to compute the steady-state distribution of water quality variables undergoing consecutive reactions with feedback and following first order kinetics. The program has been developed in a general form by is specifically applicable to the reactions observed by nitrogenous species and the associated dissolved oxygen uptake in the natural environment. The basis for this model is the theory of conservation of mass. The approach used to solve the equations is a finite difference scheme developed by Thomann, which has been shown to be a very effective tool in the field of water quality management. (See also W77-09154) (Bell-Cornell) W77-09176

MODELING THE HYDRODYNAMIC EFFECTS OF LARGE MAN-MADE MODIFICATION TO LAKES

Case Western Reserve Univ., Cleveland, Ohio. Dept. of Earth Sciences. J. F. Paul.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 171-175, July 1976. 9 fig, 4 ref.

Descriptors: *Lakes, *Hydrodynamics, Effects, *Lake Erie, *Simulation analysis, Numerical analysis, Project feasibility, Summer, Water temperature, Wind velocity, Islands, Hypolimnion, Epilimnion, Isotherms, Systems analysis, *Forecasting, Ohio.

The real value of numerical models is in their predictive capability. A three-dimensional hydrodynamic model is described which can be used as a predictive tool for assessing the possible effects of large man-made modifications to lakes. As part of a feasibility study for a proposed lake jetport in the vicinity of Cleveland, Ohio, the numerical model describing the hydrodynamics of the Lake Erie area near that city was developed to help determine the possible effects of such a jetport on the summer temperature structure in the lake. The results presented are qualitative. (See also W77-09154) (Bell-Cornell) W77-09177

AN EMPIRICAL MODEL FOR NUTRIENT RATES IN LAKE ONTARIO

Environmental Protection Agency, Rochester, New York. Rochester Field Office. For primary bibliographic entry see Field 5C. W77-09178

AN ENVIRONMENTAL RESIDUAL ALLOCATION MODEL

Energy Resources Co. Inc., Cambridge, Mass. M. Allen, and F. Lambie. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 236-240, July 1976. 1 fig, 1 tab, 8 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

Descriptors: *Environmental control, *Model studies, *Water utilization, Effects, Regional analysis, *Energy, Pollutants, Assessment, Control, Technology, Water quality, Systems analysis, Forecasting, Water allocation(Policy).
Identifiers: *Residuals allocation model, *Air quality model.

An environmental residuals technique has been developed to quantitatively evaluate the environmental implications of Project Independence. Three models are discussed that compare the regional impacts of different scenarios of energy development: a Residual Allocation Model to predict the quantity and distribution of 15 energy-associated pollutant loadings; a Water Use Model to assess the compatibility of water available and water required for projected energy use; and an Air Quality Model to compare the impacts of the scenarios on ambient air quality. The approach is useful for scenario comparison, but it is limited in degree of detail and absolute accuracy. It is concluded that the level of control technology achieved is more critical environmentally than the choice of scenarios. Further work should include a refinement and extension of the residuals studies and a more detailed sensitivity analysis, especially with respect to control technology and facility siting assumptions. (See also W77-09154) (Bell-Cornell)

W77-09179

RADIONUCLIDE REMOVAL BY THE PH ADJUSTMENT OF PHOSPHATE MILL EFFLUENT WATER.

Eastern Environmental Radiation Facility, Montgomery, Ala.
For primary bibliographic entry see Field 5D.
W77-09180

WATER QUALITY MODELING IN TEXAS,

Texas Water Quality Board, Austin. Engineering Analysis and Modeling Section.
J. J. Beal, A. P. Covar, and D. W. White.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 326-329, July 1976.

Descriptors: *Water quality control, *Mathematical models, *Texas, *Legislation, Evaluation, Wastes, Planning, River basins, Computer models, Management, Systems analysis, Decision making, Water policy.

The State of Texas, acting through the Texas Water Quality Board, has been intensely interested in Water quality modeling for the past three years. Previously, this effort dealt mainly with the waste load evaluation program, made necessary for the allocation of point source waste discharges by Public Law 92-500. A considerable amount of water quality modeling will be required for the evaluation of treatment alternatives which will be developed under Section 208 of the same law. This modeling effort will consider the effects of point and nonpoint waste sources on receiving water quality, both under steady-state and time variable conditions. This paper shows how applied models are used in planning problems and water quality management decisions in the State of Texas. The various types of models currently in use are discussed along with the State's future need for models. (See also W77-09154) (Bell-Cornell)

W77-09181

A DYNAMIC WATER QUALITY SIMULATION MODEL FOR THE THAMES RIVER,

Ontario Ministry of the Environment, Toronto (Ontario). Water Resources Branch.
D. G. Weatherbe.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22,

1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 330-334, July 1976. 4 fig, 1 tab, 6 ref.

Descriptors: *Water quality control, *Simulation analysis, *River basins, *Evaluation, *Alternative planning, Management, Drainage systems, Computer models, Streamflow, Sewage treatment, Probability, Channel flow, Temperature, Dissolved oxygen, Reservoirs, Equations, Systems analysis, *Canada.
Identifiers: *Thames River(Ontario Canada), Waste loading.

The Thames River basin in Ontario, Canada is experiencing problems of water quality and flooding, heightened by intensive agricultural use and an expanding urban population. A study was initiated to provide solutions to these problems as well as to problems of erosion, unsatisfied recreational demand, and conflicts in reservoir use. In order to provide a suitable tool for the analysis and projection of the water quality problem, a dynamic water quality simulation model was developed and applied to the major growth center, the City of London. This paper describes the major objectives of the water quality modeling, the model structure and processes, and the model input and output summaries. Application of the model to evaluate various water quality management options is described. (See also W77-09154) (Bell-Cornell)

W77-09182

DISPERSION MODEL FOR AN INSTANTANEOUS SOURCE OF POLLUTION IN NATURAL STREAMS AND ITS APPLICABILITY TO THE BIG BLUE RIVER (NEBRASKA),

Nebraska Natural Resources Commission, Lincoln.
M. K. Bansal.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 335-339, July 1976. 4 fig, 1 tab, 9 ref.

Descriptors: *Dispersion, *Natural streams, *Water pollution control, *Simulation analysis, Behavior, Equations, Pollutants, Mathematical models, Systems analysis, Sampling, *Nebraska.
Identifiers: *Big Blue River(Neb), Continuous plane source, Constituent concentration.

Dispersion behavior in natural streams depends upon dispersion rates, channel configuration, turbulent flow characteristics, and biochemical changes taking place in the stream environment. This is true for an instantaneous source of pollution for during transition periods when mixing is not complete in the reach. Therefore, the prediction of turbulent dispersion coefficients is important in the determination of water quality constituent concentration in natural streams. However, the longitudinal dispersion rates predicted by the QUAL model are low, which results in higher concentration peaks of short durations. In steady-state conditions, for a continuous plane source of pollution, the dispersion behavior in natural streams does not depend upon the dispersion rates. Under these conditions, an exact solution of the dispersion equation is available, and as such, a finite-difference approximation technique should not be used. One- and three-dimensional mathematical models of dispersion are presented herein. The turbulent dispersion coefficients calculated were tested for the Big Blue River in Nebraska. The dispersion model developed is not dependent on channel size or regional location of the stream. (See also W77-09154) (Bell-Cornell)

W77-09183

SELECTING THE PROPER REAERATION COEFFICIENT FOR USE IN WATER QUALITY MODELS,

Texas Water Quality Board, Austin. Administrative Operations.
For primary bibliographic entry see Field 5G.

W77-09184

RECEIV-II, A GENERALIZED DYNAMIC PLANNING MODEL FOR WATER QUALITY MANAGEMENT,

Raytheon Co., Portsmouth, R.I. Oceanographic and Environmental Services.

C. V. Beckers, P. E. Parker, R. N. Marshall, and S. G. Chamberlain.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 344-349, July 1976. 1 tab, 11 ref.

Descriptors: *Water quality control, *Model studies, *Simulation analysis, *Streamflow forecasting, *River basins, Estuaries, Planning, Constraints, Computer models, Computer programs, Dissolved oxygen, Biochemical oxygen demand, Equations, Systems analysis, *Rhode Island, *Connecticut.

Identifiers: *Pawtuxet River(Rhode Island), Norwalk Harbor(Connecticut), Critical period, Data requirements.

Under funding by the U.S. Environmental Protection Agency, Raytheon has developed the RECEIV-II Water Quality Model. This paper discusses the background of the model development work and describes the model in some detail. The model is intended for use in forecasting water quality on a basin-wide scale, under alternative conditions of point and non-point discharge, streamflow and desired waterway usage. The emphasis is on forecasting the far-field effects of an individual discharge or assembly of discharges. Examples include the installation of additional treatment capacity at a municipal or industrial discharge and development of a new industrial site. To illustrate model applications, results are presented from its use on the Pawtuxet River in Rhode Island and Norwalk Harbor in Connecticut. Preliminary results of the load allocation work on the Pawtuxet River illustrate the importance of nitrogenous oxygen demand in achieving water quality standards for rivers. With respect to the total treatment plant-river system, winter conditions may turn out to be the 'critical period' for maintenance of the water quality standards; a similar conclusion is reached for Norwalk Harbor but for different reasons. The paper concludes with a brief discussion of some of the apparent limitations of the model and area in which improvements have already been made by Raytheon. (See also W77-09154) (Bell-Cornell)

W77-09185

MODIFICATIONS TO QUAL - II TO EVALUATE WASTEWATER STORAGE,

Environmental Protection Agency, Atlanta, Ga. Technical Support Branch.

For primary bibliographic entry see Field 5D.

W77-09186

WATER POLLUTION MODELING IN THE DETROIT METROPOLITAN AREA,

Detroit Water and Sewerage Dept.Mich.; and Wayne State Univ. Detroit, Mich. Coll. of Engineering.

M. Selak, R. Skrentner, C. Harlow, and J. Anderson.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 353-357, July 1976. 6 fig, 7 ref.

Descriptors: *Water pollution control, *Simulation analysis, *Computer models, Waste water(Pollution), Flow, Treatment facilities, Storm water, Runoff, Evaluation, Combined sewers, Algorithms, Operations research, *Michigan.
Identifiers: *Detroit(Mich).

The EPA Storm Water Management Model (SWMM) has been used to simulate waste water flow in the Oakwood Sewer District of Detroit. This District is a 1,500-acre residential/industrial area with combined sewers from which flow is pumped to the Detroit waste water treatment plant and/or to the Rouge River during periods of high rainfall. After several minor modifications to the SWMM, the simulation results from the Runoff and Transport blocks of SWMM compared favorably with observations by the computerized monitoring system of the Detroit Water and Sewerage Department. Output from the SWMM Transport block is routed to a computer simulation of the Detroit waste water treatment plant, STP-SIM. This model enables the user to evaluate the effect of storm flow on plant performance and to compare various strategies for treating the stored waste water. The simulated results from STP-SIM appear to be quite representative of the actual treatment plant performance. However, model calibration has been difficult due to a shortage of real-time data from the plant. All of the water pollution simulation models operate on Wayne State University's 360/67 computer system in time sharing or batch mode through an executive program, the Detroit Water Quality Information System (DWQIS). In addition to the above models, DWQIS contains census and local climatological data for the Detroit area which was used to provide some of the necessary input for the SWMM. (See also W77-09154) (Bell-Cornell) W77-09187

GENERALIZED METHOD FOR EVALUATING URBAN STORM WATER QUALITY MANAGEMENT STORAGE/TREATMENT ALTERNATIVES.
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5D. W77-09188

MODELING HYDROLOGIC LAND-USE INTERACTIONS IN FLORIDA.
Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering.
P. P. Bedient, W. C. Huber, and J. P. Heaney.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 362-366, July 1976. 5 fig, 12 ref.

Descriptors: *Hydrology, *Land use, *Simulation analysis, *River basins, *Florida, Surface runoff, Water quality, Drainage patterns(Geologic), Watersheds(Basins), Water balance, Flood plains, Equations, Flood routing, Storage, Treatment, Monitoring, Pollutants, Lake basins, Equations, Mathematical models, Systems analysis.
Identifiers: *Kissimmee River Basin(Fla), Marsh areas, Soil storage, Nutrient loading rates, Linear Muskingum method.

A technique is developed to describe and quantify various hydrologic-land use interactions within a Florida river basin. Surface runoff quantity and quality are estimated as a function of land use and drainage patterns at several levels of resolution including the river basin, tributary watersheds, lake basins, and marsh areas. A hydrologic-land use model based on a daily water balance is applied to each soil-land use complex in the watershed to estimate soil storage and total runoff. The overall basin response seems to be more sensitive to the land drainage pattern than to the condition of the narrow river flood plain. Potential nutrient loading rates are calculated using measured concentrations of total P and predicted runoff volumes. The drainage density index correlates with observed concentrations and loading rates for the tributary watersheds. The detention time parameter for various hydrologic components in the basin indicates the potential for control of runoff quantity and quality through on-site storage in marsh,

pond, and lake areas. Excessive drainage activities have led to higher nutrient loads and decreased detention times in the river basin. (See also W77-09154) (Bell-Cornell) W77-09189

MODELING URBAN RUNOFF FROM A PLANNED COMMUNITY.
Espey, Huston and Associates, Inc., Austin, Tex.
E. V. Diniz, D. E. Holloway, and W. G. Characklis.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 367-371, July 1976. 6 fig, 4 tab, 6 ref.

Descriptors: *Water management(Applied), *Urban runoff, *Water utilization, Computer models, Storm water, Community development, Watersheds(Basins), Drainage, Rainfall, Computer programs, Water quality, Texas, Systems analysis, Simulation analysis.
Identifiers: *EPA storm water management model, Data sampling, Pollutant loading.

A management strategy for utilization of water resources in the planned community of The Woodlands, near Houston, Texas, is being developed by modification and Application of the EPA Storm Water Management Model (SWMM). Selected sites on Panther Branch, which flows through The Woodlands, and on Hunting Bayou, a completely developed watershed within the city limits of Houston were modeled for testing and verification of the modifications to the SWMM. The capacity of the SWMM to model urban runoff quantity has been improved to include the 'natural' drainage concepts of The Woodlands and the infiltration computation model in the SWMM is now capable of operating with a rainfall record which includes periods of zero rainfall. Three subroutines have been written to operate in conjunction with the SWMM. The three subroutines generate normalized area-discharge curves for natural sections, model baseflow conditions, and model the operation of porous pavements, respectively. Verification of the SWMM with regard to suspended solids and BOD was attempted, and modifications to predict COD, Kjeldahl nitrogen, nitrates and phosphates were performed. (See also W77-09154) (Bell-Cornell) W77-09190

EVALUATION AND SELECTION OF WATER QUALITY MODELS: A PLANNER'S GUIDE.
Systems Control, Inc., Palo Alto, Calif.
E. J. Finnemore, and G. P. Grimsrud.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 391-395, July 1976. 4 tab, 2 ref.

Descriptors: *Water quality control, *Mathematical models, *Planning, *Evaluation, *Simulation analysis, Management, Constraints, Costs, Behavior, Estuaries, Streams, Lakes, Economics, Systems analysis.
Identifiers: *Cost-effectiveness, Resource needs.

As part of a management guide for planners, Systems Control, Inc., recently developed for the Environmental Protection Agency systematic procedures for evaluating and selecting receiving water quality models. Using these procedures, each model is evaluated on the basis of many considerations, which include both the technical principles and capabilities of the models and such resource needs and constraints as additional labor, specialized technical expertise, time and funds, and computer limitations. All these considerations are combined into a single performance index. A procedure is also prescribed for combining the various component costs of applying the model into a single overall cost. A comparison of this

overall application cost with the model's performance index may then be used as a guide to model selection. The selection procedure is organized into phases of increasing level of detail, each of which may or may not be required, depending upon the nature of the planning problem being confronted. (See also W77-09154) (Bell-Cornell) W77-09191

A RESOURCE ALLOCATION MODEL FOR THE EVALUATION OF ALTERNATIVES IN SECTION 208 PLANNING CONSIDERING ENVIRONMENTAL, SOCIAL AND ECONOMIC EFFECTS.
Grumman Ecosystems Corp., Bethpage, N.Y.
For primary bibliographic entry see Field 5G. W77-09192

REGIONAL RESIDUALS-ENVIRONMENTAL QUALITY MANAGEMENT MODELS: APPLICATION TO EPA'S REGIONAL MANAGEMENT PROGRAMS.
Resources for the Future, Washington, D. C.
Quality of the Environment Program.
For primary bibliographic entry see Field 5G. W77-09193

A COMPUTER MODELING STUDY TO ASSESS THE EFFECTS OF A PROPOSED MARINA ON A COASTAL LAGOON.
Connell/Metcalf and Eddy, Coral Gables, Fla.
For primary bibliographic entry see Field 5C. W77-09194

COMPUTER SIMULATION OF LONG-TERM SECONDARY IMPACTS OF WATER AND WASTEWATER PROJECTS.
Boyle Engineering Corp., Newport Beach, Calif.
Environmental Studies.
G. A. Guter, J. F. Westermeier, and T. C. Ryan.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 424-428, July 1976. 3 fig, 4 tab, 3 ref.

Descriptors: *Computer models, *Simulation analysis, *Water resources, *Waste water(Pollution), *Projects, Environment, Planning, Decision making, Regions, Systems analysis, California, Water supply, Irrigation, Arizona.
Identifiers: Environmental policy, Natural sciences, Social sciences, Environmental studies, Environmental design arts, *Environmental impacts.

Applications of the KSIM technique were made in the course of environmental studies for water and wastewater projects. The National Environmental Policy Act mandates a systematic interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decision making which will have an impact on man's environment. KSIM is being employed as a part of this interdisciplinary approach. This application of KSIM requires modification of published techniques for water resource planning and adaptation to the cases discussed. The computer simulation, as applied to three water and wastewater projects, is discussed herein. These projects include an Area-wide Facilities Plan for the Las Virgenes Municipal Water District in Los Angeles and Ventura Counties, California; a Master Plan of Water and Reclamation Facilities for Los Alisos Water District, Orange County, California; and an irrigation project on the Colorado River Indian Reservation in western Arizona. In considering the application of KSIM to the above projects, major advantages, acceptability to reviewers and agencies, types of projects to which KSIM appears applicable, and further research on the methods are discussed. (See also W77-09154) (Bell-Cornell) W77-09195

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

ENVIRONMENTAL, FISCAL AND SOCIO-ECONOMIC IMPACT OF LAND USE POLICIES: TOWARD AN INTERACTIVE ANALYSIS. Meta Systems Inc., Cambridge, Mass. For primary bibliographic entry see Field 6B. W77-09196

ECONOMIC FORECASTING FOR VIRGINIA'S WATER RESOURCE PROGRAMS. Virginia State Water Control Board, Richmond. For primary bibliographic entry see Field 6B. W77-09197

A RIVER BASIN PLANNING METHODOLOGY FOR STREAMS WITH DISSOLVED OXYGEN AND EUTROPHICATION CONSTRAINTS. Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab. T. M. Walski, and R. G. Curran. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 532-536, July 1976. 3 fig, 5 ref.

Descriptors: *River basins, *Planning, *Methodology, *Water quality control, *Linear programming, *Waste water treatment, *Pollutants, Optimization, Economic efficiency, Dissolved oxygen, Standards, Simulation analysis, Eutrophication, Constraints, Computer models, Computer programs, Streams, Effluents, Algorithms, Programs, Equations, Systems analysis, Mathematical models. Identifiers: *Cost minimization, Sensitivity.

Optimal Waste Load Allocation Program 2 (OWLAP2) is a user-oriented optimization model which selects wastewater treatment levels to meet water quality constraints at least cost. This program solves the problem faced by river basin planners, who by merely insuring that each wastewater discharge meets effluent standards, will still be unable to meet water quality standards. The program selects the minimum cost combination of additional treatment alternatives in the basin which will insure that water quality standards will be met. OWLAP2 first simulates water quality in the river reaches; it then perturbs the initial conditions to determine the sensitivity of water quality to changes in effluent. It uses these sensitivities as inputs to an algorithm for linearizing nonlinear systems so that they can be optimized utilizing linear programming. (See also W77-09154) (Bell-Cornell) W77-09198

APPLICATION OF STORM AND SWMM FOR ASSESSMENT OF URBAN DRAINAGE ALTERNATIVES IN CANADA. MacLaren (James F.) Ltd., Willowdale (Ontario). P. E. Wisner, A. F. Roake, and A. F. Ashamalla. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 563-567, July 1976. 1 fig, 3 tab, 18 ref, append.

Descriptors: *Urban runoff, *Urban drainage, *Model studies, *Simulation analysis, *Computer models, *Flood control, *Water pollution control, *Alternative planning, Research, Decision making, Assessment, *Canada, Watersheds(Basins), Methodology, Hydrologic data, Sewers, Systems analysis. Identifiers: *Screening models.

A limited program of research and several applications of urban runoff models indicate that there is no unique pattern for model application in drainage and pollution control studies. Use of the simplest model compatible with the requirements of planners and decision makers helps to minimize unnecessary data collection and avoid communi-

cation problems. More sophisticated models will be required as a study progresses from screening and initial planning phases to the final planning and design phases. STORM is considered primarily as a screening model for comparison of alternatives, identification of critical events, and problem definition. For predominately urban areas, a lumped SWMM and a recently developed Generalized Quality Model are considered as planning models for the analysis of critical events. A detailed SWMM and the WREM are considered as tools for final planning and design work. A computerized unit hydrograph approach is preferred for planning in areas with low percentage imperviousness, while the comprehensive analysis of Stanford-type models is recognized as necessary for major projects in large watersheds. (See also W77-09154) (Bell-Cornell) W77-09199

SIMULATION AND MATHEMATICAL MODELING OF WATER SUPPLY SYSTEMS - STATE-OF-THE-ART. Michigan Univ., Ann Arbor. School of Public Health. For primary bibliographic entry see Field 4A. W77-09200

CAPACITY EXPANSION FOR MUNICIPAL WATER AND WASTEWATER SERVICES: INCORPORATION OF UNCERTAINTY. Curran Associates, Inc., Northampton, Mass. For primary bibliographic entry see Field 5D. W77-09201

ADAPTIVE SHORT-TERM WATER DEMAND FORECASTING. Systems Control, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 6D. W77-09202

HYDROLOGIC IMPACT STUDIES OF ALTERNATIVES TO MEET WATER NEEDS IN SOUTH CENTRAL PENNSYLVANIA. Resource Analysis Inc., Cambridge, Mass. For primary bibliographic entry see Field 6D. W77-09203

THE OPERATIONAL WATER QUANTITY MODEL. Central and Southern Florida Flood Control District, West Palm Beach. Resource Planning Dept. For primary bibliographic entry see Field 4A. W77-09204

NEW MODELS FOR OPTIMAL SEWER SYSTEM DESIGN. Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W77-09205

SWAN, A SEWER ANALYSIS AND MODELING SYSTEM. Erdman Anthony, Associates. Rochester, N.Y. For primary bibliographic entry see Field 5D. W77-09206

ON-LINE MODELS FOR COMPUTERIZED CONTROL OF COMBINED SEWERS. Colorado State Univ., Fort Collins. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D. W77-09207

MATHEMATICAL MODELS FOR CALCULATING PERFORMANCE AND COST OF WASTE-WATER TREATMENT SYSTEMS. Municipal Environmental Research Lab., Cincinnati, Ohio. Systems and Economic Analysis Section. For primary bibliographic entry see Field 5D. W77-09208

THE COST OF WATER SUPPLY UTILITY MANAGEMENT. Municipal Environmental Research Lab., Cincinnati, Ohio. Water Supply Research Div. For primary bibliographic entry see Field 6B. W77-09209

MATHEMATICAL MODELING OF DUAL WATER SUPPLY SYSTEMS. Weston (Roy F.), Inc., West Chester, Pa. For primary bibliographic entry see Field 6D. W77-09210

DATA COLLECTION FOR WATER QUALITY MODELING IN THE OCCOQUAN WATERSHED OF VIRGINIA. Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. For primary bibliographic entry see Field 5A. W77-09211

WATER SUPPLY SYSTEMS PLANNING, MANAGEMENT AND COMMUNICATION THROUGH AN INTERACTIVE RIVER BASIN SIMULATION MODEL. Ohio River Div. Labs., Mariemont. For primary bibliographic entry see Field 6B. W77-09212

FUTURE DIRECTIONS IN URBAN WATER MODELING. Water Resources Engineers, Inc., Walnut Creek, Calif. For primary bibliographic entry see Field 5D. W77-09213

MALVERN URBAN TEST CATCHMENT, VOLUME I. Canada Centre for Inland Water, Burlington (Ontario). For primary bibliographic entry see Field 4D. W77-09217

ENVIRONMENTAL CONTAMINANTS INVENTORY STUDY NO. 3, THE PRODUCTION, USE AND DISTRIBUTION OF LEAD IN CANADA. Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch. T. D. Leah. Report Series No 41, 1976, 94 p, 6 fig, 28 tab, 118 ref, 3 append, 3 graphs, 6 maps.

Descriptors: *Lead, *Environmental effects, Watersheds(Basins), *Human diseases, Evaluation, Analysis, Industrial production, Distribution, Pollution, Soils, Vegetation, Aquatic populations, Mammals, Mining, Atmosphere, Fallout, Gasoline, *Canada, *Path of pollutants, Recycling, Air pollution, Industrial wastes, Water pollution effects.

This study is the third in the Environmental Contaminants Inventory Series, and the first to present data in terms of watershed basins. A literature review is included on lead in the environment and the effects of lead on human health. The flow of lead through the Canadian economy is analyzed, focussing on the production of lead and the use of lead in manufacturing. Lead releases to the atmosphere resulting from these activities and the consumption of leaded gasoline are estimated

in terms of aggregated watershed basins. Background information is provided outlining the occurrence, physical and chemical properties, production processes, global economic significance, major uses of lead and future demand for lead. Lists of industries reporting lead consumption to Statistics Canada in 1972 and major Canadian producers of recycled lead are included. (WATDOC)
W77-09221

EFFECTS OF IMPOUNDMENT ON WATER AND SEDIMENT IN THE ARKANSAS RIVER AT PUEBLO RESERVOIR,

University of Southern Colorado, Pueblo.

S. J. Hermann, and K. I. Mahan.

Bureau of Reclamation, Denver, Colorado, Engineering and Research Center, Report REC-ERC-76-19, May 1977. 159 p, 24 fig, 4 tab, 22 ref, 4 append. 14-06-700-7716.

Descriptors: *Water quality, Water analysis, *Limnology, *Trace elements, Heavy metals, Suspended solids, Pre-impoundment, Post-impoundment, Multiple purpose reservoirs, Sediments, Chemical wastes, Water pollution effects, Sediment load, *Colorado, Pollutant identification, Water pollution sources, Reservoirs.
Identifiers: *Pueblo Reservoir, CO, *Arkansas River.

The water quality of Pueblo River was studied from June 1974 to March 1976. General limnological parameters included dissolved oxygen, conductivity, pH turbidity, alkalinity, sulfate, temperature, hardness, chloride, total dissolved solids, and total suspended matter. Concentrations of the following elements were also monitored monthly in both the dissolved and suspended water fractions: Ag, Cu, Fe, Mn, Zn, Co, Pb, Cd, Hg, Li, Na, K, As, Ni, Mg, and Ca. Pre- and post-impoundment water quality conditions were compared. Pre- and post-impoundment sediments were also analyzed for K, Na, Ca, Mg, Li, Cu, Cd, Pb, Fe, Mn, Zn, and Mo, and compared. Seasonal, surface, spatial, and depth trends were observed for most parameters. The most frequent seasonal trend for chemical parameters was that of classic high winter values (low discharge) and low summer values (high discharge). Trends for Fe, Mn, and Zn did not follow classical expectations. The data tend to support the inference that the inlet sediments especially are being enriched with a number of trace metals (Fe, Mn, Zn, and perhaps Mg, Cu, Cd, and Pb). (Bur Reclam)
W77-09224

OIL TRANSPORTATION BY TANKERS: AN ANALYSIS OF MARINE POLLUTION AND SAFETY MEASURES.

Office of Technology Assessment, Washington, D.C.

For primary bibliographic entry see Field 5G.
W77-09238

MAY 1974 BASELINE INVESTIGATION OF DEEPWATER DUMPSITE 106.

National Oceanic and Atmospheric Administration, Washington, D.C.; and Environmental Protection Agency, Washington, D.C.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 657, Price codes: A17 in paper copy, A01 in microfiche. NOAA Dumpsite Evaluation Report 75-1, December 1975. 395 p.

Descriptors: *Baseline studies, Water resources, *Resources development, *Waste disposal, *Heavy metals, *Radioactive waste disposal, *Water pollution, New York, New Jersey, Nutrients, Aquatic life, Monitoring, Pollutant identification, Water pollution sources.
Identifiers: *Outer Continental Shelf, *Ocean dumping, *Dumpsites, *New York Bight.

The National Oceanic and Atmospheric Administration (NOAA) has basic responsibility to conduct programs of monitoring and research to determine the effects of ocean dumping. In May, 1974, NOAA conducted an environmental baseline investigation in the Deepwater Dumpsite (DWD-106) and its vicinity, located 90-miles east of Cape Henlopen, Delaware, in which large amounts of industrial wastes from the New York/New Jersey metropolitan area are dumped. This document presents the reports by the individual principal investigators, including a summary chapter containing major findings. (See W77-09244 thru W77-09255) (Sinha-OEIS)
W77-09243

NOAA SHIP ALBATROSS IV CRUISE 74-5 REPORT OF MAY 9-24, 1974 SURVEY OF DEEPWATER DUMPSITE 106.

NOAA National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group. M. C. Ingham.

In: NOAA Dumpsite Evaluation Report 75-1, p 7-12, December 1975. 2 fig, 3 tab.

Descriptors: *Baseline studies, *Environmental effects, Water resources, Bottom sediments, *Sampling, *Surveys, *Monitoring, Waste disposal, Pollutant identification, Water pollution sources.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites.

Cruise 74-5 by NOAA ship Albatross IV, and cruise 74-2 by NOAA ship Delaware II, were part of a joint effort during the May 1974 field investigation of Deepwater Dumpsite 106. This report describes the sampling operations of the Albatross IV during the period May 9 through 24, 1974, in and near Deepwater Dumpsite 106. Twenty-three stations of the established survey grid of 33 stations were occupied in and near the dumpsite. The pattern of stations occupied yields three sections from shelf to deep water passing through the dumpsite. The data collected on the cruise is summarized in a table. (See also W77-09243) (Sinha-OEIS)
W77-09244

NOAA SHIP DELAWARE II CRUISE 74-2 REPORT OF MAY 13-21, 1974, SURVEY OF DEEPWATER DUMPSITE 106.

National Marine Fisheries Service, Highlands, N.J. Middle Atlantic Coastal Fisheries Center. J. P. Thomas, and J. B. Pearce.

In: NOAA Dumpsite Evaluation Report 75-1, p 13-19, December 1975. 4 tab.

Descriptors: *Baseline studies, *Environmental effects, Water resources, Bottom sediments, Sampling, Surveys, Chemistry, Biology, Geology, Monitoring, Pollutant identification, Water pollution sources.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites, Environmental impact.

Cruise 74-2 by NOAA ship Delaware II, and cruise 74-5 by NOAA ship Albatross IV, were part of a joint effort during the May 1974 field investigation of Deepwater Dumpsite 106. Objectives of the cruise were to study the chemical, biological, and geological characteristics of Deepwater Dumpsite 106, particularly during the spring season, and to use the data in preparing an environmental impact statement. These data are being analyzed to assess the distribution and abundance of benthic biota, the distribution and concentration of heavy metals in benthic biota and sediments, the grain-size characteristics and distribution of sediments, the fate of containerized radioactive wastes disposed of at 38 degrees 30 minutes N, 72 degrees 6 minutes W, and the seasonal temperature structure of the water column and movements of the deepscattering layer. (See also W77-09243) (Sinha-OEIS)
W77-09245

INVESTIGATION OF RADIOACTIVE WASTE DISPOSAL AT DEEPWATER DUMPSITE 106—SAMPLING PROGRAM MAY 1974.

Office of Radiation Programs, Washington, D.C.

R. Dyer.

In: NOAA Dumpsite Evaluation Report 75-1, p 21-25, December 1975. 3 tab.

Descriptors: *Baseline studies, *Biota, *Radioactive waste disposal, Bottom sediments, *Sampling, Resource development, Monitoring, Pollutant identification, Water pollution sources.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites.

The sediment and biota sampling program to determine the fate of radioactive wastes at Deepwater Dumpsite 106 during the May 1974 field investigations is described. The primary objective was to investigate a deepwater radioactive waste disposal site approximately 10 miles square. Deepwater trawl biological samples and sediment grab samples taken by the Delaware II in adjacent areas were to provide background or control levels of radioactivity attributable to naturally occurring and fallout radionuclides. (See also W77-09243) (Sinha-OEIS)
W77-09246

PHOTOGRAPHIC RECONNAISSANCE OF CONTINENTAL SLOPE AND UPPER CONTINENTAL RISE,

Lamont-Doherty Geological Observatory, Palisades, N.Y.

B. C. Heezen.

In: NOAA Dumpsite Evaluation Report 75-1, p 27-103, December 1975. 40 fig, 2 tab, 38 ref. NOAA-01-5-022-591.

Descriptors: *Baseline studies, *Photography, *Bottom sediments, Continental slope, Sediment, Waste disposal, Geology, Water pollution.
Identifiers: *Outer Continental Shelf, *Ocean dumping, *Dumpsites, Reconnaissance, Continental rise.

In May 1974 a series of 11 camera stations were made from Albatross IV on the continental slope and upper continental rise. The upper continental rise appears to be a remarkably tranquil area of deposition. This environment has prevailed for more than 20 million years and it seems likely that it will continue to be tranquil in the dumpsite area during the immediate geological future. The lower continental rise is an area of shifting deposition whereas the transition zone between the two provinces is an area of erosion. Evidence of erosion and slumping is found at the base of the continental slope. Here the echogram hyperbolae suggest a pattern related to contour current action. This could be significant for the fate of material placed on the sea floor in this environment. The assembled data in this report are intended as background material for the manned dive series to investigate the area of the deepwater dumpsite. (See also W77-09243) (Sinha-OEIS)
W77-09247

PHYSICAL OCEANOGRAPHY HISTORICAL DATA FOR DEEPWATER DUMPSITE 106.

National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group. C. E. Warsh.

In: NOAA Dumpsite Evaluation Report 75-1, p 105-140, December 1975. 21 fig, 43 ref.

Descriptors: *Baseline studies, Water quality, *Waste disposal, Data collections, Water pollution sources.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites.

Deepwater Dumpsite 106 covers 480 sq. nmi. and is located between latitudes 38 degrees 40 minutes N and 39 degrees 00 minutes N and longitudes 72 degrees 00 minutes W and 72 degrees 20 minutes

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

W in 2700 m of water. It is the purpose of this paper to characterize the water column above and adjacent to the site on the basis of historical and field data. This characterization is necessary to help plan at-sea surveys and to provide a data base for use in assessing the feasibility of continued use of the dumpsite. (See also W77-09243) (Sinha-OEIS)
W77-09248

PHYSICAL OCEANOGRAPHIC OBSERVATIONS AT DEEPWATER DUMPSITE 106 -- MAY 1974, National Marine Fisheries Service, Narragansett, R. I. Atlantic Environmental Group. C. E. Warsh.
In: NOAA Dumpsite Evaluation Report 75-1, p 141-187, December 1975. 34 fig, 6 ref, append.

Descriptors: *Water resources, Water quality, *Water pollution sources, *Baseline studies, *Sampling, Oceanography, Pollutant identification, Monitoring.
Identifiers: *Outer Continental Shelf, *Ocean dumping, *Dumpsites, Oceanographic data.

A cruise to study the water in and near Deepwater Dumpsite 106 was made by the NOAA ship Albatross IV from May 9 through May 24, 1974. Physical, chemical, and biological sampling were completed. This discussion is concerned with only the physical data and some chemical data. Twenty-three stations were occupied during the cruise. Physical and chemical data were collected at all stations except No. 3. A total of 99 expendable bathythermographs (XBTs) were dropped to depths of 1800 m. XBT drops were made at the start and finish of each station and between stations. At each station a 9040 STD (salinity, temperature, depth recorder) was lowered to depths of 1500 m to record temperature and salinity. A rosette sampler was attached to the STD to obtain supporting chemical data. Where depths exceeded 1500 m, hydrocasts were made from 1300 m to near the bottom to collect temperature, salinity, oxygen, and nutrient data. Temperature was measured by reversing thermometers, salinity on board by an inductive salinometer, and oxygen by the Winkler method. (See also W77-09243) (Sinha-OEIS)
W77-09249

MICRONUTRIENT ANALYSIS OF SEAWATER SAMPLES TAKEN AT DEEPWATER DUMPSITE 106--MAY 1974, National Marine Fisheries Service, Narragansett, R.I. MAMAP Field Group.
For primary bibliographic entry see Field 5A.
W77-09250

ANALYTICAL RESULTS FOR WATER-COLUMN SAMPLES COLLECTED AT DEEPWATER DUMPSITE 106--MAY 1974, Environmental Protection Agency, Edison, N.J. Technical Support Group.
For primary bibliographic entry see Field 5A.
W77-09251

PRELIMINARY INVESTIGATION OF BENTHIC RESOURCES AT DEEPWATER DUMPSITE 106, National Marine Fisheries Service, Highlands, N.J. Middle Atlantic Coastal Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-09252

ARCHIBENTHIC AND ABYSSOBENTHIC FISHES OF DEEPWATER DUMPSITE 106 AND THE ADJACENT AREA, Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5C.
W77-09253

AN ANALYSIS OF PLANKTON FROM DEEPWATER DUMPSITE 106, New York Ocean Science Lab., Montauk. Dept. of Fisheries Oceanography.
For primary bibliographic entry see Field 5C.
W77-09254

SYSTEMATIC ANALYSIS OF MIDWATER FISHES OBTAINED AT DEEPWATER DUMPSITE 106 MAY 1974, Rhode Island Univ., Kingston. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-09255

INFLUENCE OF VEGETATION MANAGEMENT ON YIELD AND QUALITY OF SURFACE RUNOFF, Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 4C.
W77-09266

URBAN WATER RUNOFF AND WATER QUALITY CONTROL, Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center. J. T. Wildrick, K. Kuhn, and W. R. Kerns.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 411. Price codes: A03 in paper copy, A01 in microfiche. Completion Report, December 1976. 37 p, 12 fig, 1 tab, 44 ref. OWR T-0001(No. 6700)(1).

Descriptors: *Urban runoff, *Water quality control, Management, Planning, *Pollution abatement, Surveys, *Storm drains, *Detention reservoirs, *Erosion control, *Storm runoff, Water pollution sources.
Identifiers: Control methods, *Non-point pollution sources, Planning guidelines, Integrated strategy.

The 1972 Amendments to FWPCA specifically require that non-point sources of water pollution be considered in the development of water quality management plans for both local and areawide planning. Urban runoff often accounts for a major portion of the non-point pollution load. The purpose of this manual is to explore the possibilities available to urban areas for reducing levels of pollution from urban runoff. The manual contains an assessment of the seriousness of urban non-point pollution, a survey of the control methods available for combating non-point urban pollution, and some planning guidelines for developing an integrated strategy of controls. It is not a technical manual but rather was designed as a general knowledge brochure.
W77-09267

AMMONIA TRANSPORT IN WATER SATURATED POLYMERIC FILMS, Missouri Univ.-Kansas City. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-09274

INFLUENCE OF CROP MANAGEMENT PRACTICES ON NUTRIENT MOVEMENT BELOW THE ROOT ZONE IN NEBRASKA SOILS, Nebraska Univ., Lincoln. Agricultural Experiment Station.
For primary bibliographic entry see Field 2G.
W77-09279

NITROGEN BALANCE IN THE SOUTHERN SAN JOAQUIN VALLEY, California Univ., Davis. Water Science and Engineering Section. R. J. Miller, and R. B. Smith.
Journal of Environmental Quality, Vol 5, No 3, p 274-278, July-September 1976. 2 fig, 5 tab, 21 ref.

Descriptors: *Nitrate, *Nitrogen, *California, Nitrogen cycle, Analytical techniques, Methodology, Soil analysis.
Identifiers: *Nitrogen balance, *San Joaquin Valley (Calif).

A nitrogen balance for the southern San Joaquin Valley of California has been calculated using techniques and methodology developed for the Upper Santa Ana River Basin of southern California. The two areas differed considerably in both size (the latter being much smaller) and agricultural function. Data were compiled in N inputs, use, and outputs for many sources within the study area. Such data enabled construction of a flow diagram depicting best estimates of N pools and fluxes within the San Joaquin Valley Basin. Results show N inputs into the study area from various sources were somewhat greater than output to the atmosphere and by plant removal. Inputs to the soil N pool were about 9 kg/ha more in 1971 than in 1961. Since the soil N pool was estimated to be about 11 metric tons/ha, this represented an increase of about 0.1%. However, since the increases of N are not evenly distributed over the study area, high N concentrations can develop in some local areas. (Skogerboe-Colorado State)
W77-09284

EFFECT OF MICROORGANISMS ON THE SORPTION AND FATE OF SULFUR DIOXIDE AND NITROGEN DIOXIDE IN SOIL, Cornell Univ. Agricultural Experiment Station, Ithaca, N.Y. Dept. of Agronomy. W. C. Ghiorse, and M. Alexander.
Journal of Environmental Quality, Vol. 5, No. 3, p 227-230, July-September, 1976. 3 fig, 4 tab, 22 ref.

Descriptors: *Sorption, *Nitrification, *Microorganisms, Sulfur compounds, Soils, Soil analysis, Path of pollutants, *Oxides, Water pollution sources.
Identifiers: *Sulfur dioxide, *Nitrogen dioxide.

Sulfur dioxide was rapidly removed from the gas phase in contact with both nonsterile and sterile soil so that viable microorganisms are not directly involved in removal of this pollutant from the atmosphere. Sulfate was formed from the SO₂ in nonsterile and sterile soil. About one-fourth of the sulfur from the SO₂ introduced was not recovered in organic form, but the recovery was quantitative if the soil was first ignited to destroy organic matter. Nitrogen dioxide was also readily lost from the gas phase in contact with nonsterile and sterile soil, and both nitrite and nitrate were generated. The role of microorganisms in the fate of this pollutant is in the conversion of the nitrite to nitrate. (Skogerboe-Colorado State)
W77-09285

RESIDUES OF DICHLOBENIL IN IRRIGATION WATER, Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Irrigation Research Lab. K. H. Bowmer, E. M. O'Loughlin, K. Shaw, and G. R. Sainty.
Journal of Environmental Quality, Vol. 5, No. 3, p 315-319, July-September 1976. 3 fig, 4 tab, 15 ref.

Descriptors: *Herbicides, *Irrigation canals, Irrigation effects, Irrigation water, Aquatic weeds, Crop production, Path of pollutants, Water pollution sources, Pesticide residues.

Field trials were made on two unlined irrigation channels to measure the extent of water contamination due to residues of dichlobenil which had been applied to the empty channel the previous winter. Ten weeks after application, the herbicide remaining in the soil was about 6% of the initial application. About 4 months after application, water was passed through the channels and wasted into drains. The maximum herbicide concentration

in this flushing water was 0.18 ppm and was judged to present no potential hazard to crops. The need for prolonged channel flushing is questioned. An alternative procedure, displacing the static water in the channel following by a period of ponding, is suggested as a means of avoiding high herbicide residues in irrigation water. (Skogerboe-Colorado State)

W77-09287

THE EFFECT OF TEMPERATURE AND SOIL WATER ON CONVERSION OF DDT TO DDE IN SOIL.

Agricultural Research Service, Fort Collins, Colo. W. D. Guenzi, and W. E. Beard. Journal of Environmental Quality, Vol. 5, No. 3, p 243-246, July-September 1976. 2 fig, 2 tab, 13 ref.

Descriptors: *Pesticides, *Insecticides, *Chemical degradation, *Persistence, *Microbial degradation, Soil water, Soil investigations, Temperature, *DDT, *DDE.

A laboratory study was conducted to determine the rates of DDT degradation and DDE formation in soil. Degradation rates increased with higher temperatures and in the presence of water. Of the DDT mixed with Raber silty clay loam, 82.1, 74.5, 53.2, and 38.3% was recovered as DDT and 6.7, 12.5, 21.6, and 34.8% as DDE after 140 days incubation at 30, 40, 50, and 60°C, respectively. A comparison of DDE formation in sterile and nonsterile soil showed that 84% of the conversion was due to a chemical process at 30°C, and at 91% at 60°C. In sterile systems at 30°C, rates of DDE formation were similar in submerged soil and soil at 1/3 bar suction, and both were much higher than in air-dried soil. (Skogerboe-Colorado State)

W77-09289

CALCIUM RETENTION IN RESPONSE TO PHOSPHATE SORPTION BY SOILS.

Massey Univ., Palmerston North (New Zealand). Dept. of Soil Science.

For primary bibliographic entry see Field 2G.

W77-09291

USE OF UNDISTURBED CORES OF SURFACE SOIL FOR INVESTIGATING LEACHING LOSSES OF SULPHUR AND PHOSPHORUS.

Victoria Dept. of Agriculture, Melbourne (Australia). Div. of Agricultural Chemistry.

For primary bibliographic entry see Field 2G.

W77-09309

DISTRIBUTION OF NUTRIENTS IN LOUISIANA'S COASTAL WATERS INFLUENCED BY THE MISSISSIPPI RIVER.

Louisiana State Univ., Baton Rouge. Dept. of Marine Science; and Louisiana Wildlife and Fisheries Commission, Baton Rouge. Seafood Div. C. L. Ho, and B. B. Barrett.

Louisiana State University Center for Wetland Resources, Reprint No. LSU-R-77-002. Reprinted from: Estuarine and Coastal Marine Science, Vol 5, p 173-195, 1977. 15 fig, 9 tab, 21 ref.

Descriptors: *Gulf of Mexico, *Louisiana, *Nutrients, Water resources, *Estuaries, *Organic matter, Coasts, *Mississippi River, Marshes, Distribution patterns, Water sampling, Water analysis, Pollutant identification, Water pollution sources.

The volume of freshwater introduced into Louisiana's coastal zone during 1973, by rainfall and river discharge, was the highest in the past 35 years. Water samples were taken from inshore estuarine areas as well as in the open Gulf of Mexico during 1973. Analysis of the water samples showed that the nutrient content of the water within the zone of the Mississippi River influence is directly related to the volume discharged to the Gulf by the river. Drainage water from the

marshes into the upper regions of Bartaria and Caminada Bays was characterized by high levels of NH₄-N and organic-N, but low values of NO₃-N as compared to waters influenced by the Mississippi River. Coastal waters adjacent the river mouth were dominated by low nutrient seawater. However, inorganic nutrients and organic-N in the bays and their adjacent nearshore waters were higher than at the river mouth during low river discharge. The primary source of nutrients and organic matter to the bays is the surrounding marshes. The high fishery productivity of the water adjacent the river mouth is a result of nutrient contribution by the Mississippi River. (NOAA)

W77-09323

PROCEEDINGS OF THE EIGHTH DREDGING SEMINAR.

Texas A and M Univ., College Station. Center for Dredging Studies.

For primary bibliographic entry see Field 2L.

W77-09325

FINE-GRAINED SEDIMENT AND INDUSTRIAL WASTE DISTRIBUTION AND DISPERSAL IN NEW BEDFORD HARBOR AND WESTERN BUZZARDS BAY, MASSACHUSETTS.

Woods Hole Oceanographic Institution, Mass. Dept. of Geology and Geophysics.

C. P. Summerhayes, J. P. Ellis, P. R. Briggs, and M. G. Fitzgerald.

Technical Report No. WHOI-76-115, April 1977. 46 fig, 11 tab, 73 ref. SG-04-6-158-44016, SG-04-6-158-44106.

Descriptors: *Estuaries, *Sedimentation, *Water pollution, Harbors, Metals, Barriers, Waste disposal, Industrial wastes, Domestic wastes, *Massachusetts, Path of pollutants.

Identifiers: *New Bedford Harbor(MA), *Western Buzzards Bay(MA).

The findings of a two-year study designed to establish and explain the past and the present patterns of movement and accumulation of fine-grained sediment, human waste, and industrial waste in New Bedford Harbor and its approaches are presented. The major findings of this study are: (1) the construction of a hurricane barrier has caused a significant increase in the sedimentation rate in New Bedford Harbor; (2) the harbor acts as an imperfect trap for materials that are introduced into it, thereby allowing the transfer of industrial contamination to Buzzards Bay; and (3) the surface and near surface sediments of New Bedford Harbor are highly enriched in metals, these metals having been derived locally.

W77-09326

SEWAGE DISCHARGES FROM SHIPS TRANSITING COASTAL SALT WATERS.

David W. Taylor Naval Ship Research and Development Center, Annapolis, Md. Pollution Abatement Div.

W. van Hees.

Water Resources Bulletin, Vol.13, No 2, p 215-229, April 1977. 4 fig, 1 tab, 25 ref.

Descriptors: *Path of pollutants, Water pollution, *Ships, *Sewage, Coasts, Harbors, Estuaries, Rivers, Sewage disposal, Sewage effluents, Sewage treatment, Bacteria, Viruses, Coliforms, Pollutants, On-site investigations, Water quality, *Water pollution sources.

Identifiers: *Ship's discharges, Seawater quality, Sewage dispersion.

A number of aspects of the discharging of non-oily wastewaters by transiting ships were treated in this overview paper. Options to discharging (the use of holding tank, on board treatment) and the impact of changing regulations were discussed. Assessment of the effects of sewage discharges on coastal waters required that data, at first not

available, be generated. An account was given of the characterization of Navy shipboard wastewaters and of experiments involving sewage discharges at sea, measurements of water quality before, during and after an amphibious operation, and fore and aft of transiting Navy ships. A better understanding of sewage dilution after discharge led to the verification of a method for controlled discharging of sewage (and other wastewaters). This method permits limiting the coliform bacteria count in the ship's wake to values below acceptable limits. The paper contained information on long-range effects of ships' sewage discharges, obtained in studies by the U.S. Navy and others, as well as public health considerations. (Sims-ISWS)

W77-09333

USE OF LARGE SUBMERGED CHAMBERS TO MEASURE SEDIMENT-WATER INTERACTIONS.

Great Lakes Basin Commission, Ann Arbor, Mich.

W. C. Sonzogni, D. P. Larsen, K. W. Malueg, and M. D. Schuldt.

Water Research, Vol. 11, No. 5, p 461-464, May 1977. 3 fig, 2 tab, 15 ref.

Descriptors: *Sediment-water interfaces, *Phosphorus compounds, *Eutrophication, *Sediments, *Interfaces, Phosphates, Instrumentation, Water pollution sources, Nutrient removal, Phosphorus, Chemical analysis, Water quality, Analytical techniques, Dissolved oxygen, Oxygen demand, On-site tests, Lake sediments, *Minnesota.

Identifiers: *Submerged chambers, *Phosphorus release rates, *Oxygen consumption rates, *Shagawa Lake(Minn), *Lake renewal efforts, Nutrient sources, Particulate phosphorus, Oxygen sinks, Phosphorus interchange, Sediment oxygen demand.

Submerged chambers were designed and constructed primarily to study in situ sediment phosphorus release in Shagawa Lake, Minnesota. Initial experiments indicated anoxic phosphorus release rates of 7 mg/sq m/day. Oxygen consumption rates within the chambers also were measured; an average consumption rate of 0.17g/sq m/day was obtained. (Henley-ISWS)

W77-09343

STUDIES OF THE MIXING OF COASTAL WATERS IN LIVERPOOL BAY USING DISSOLVED SILICATE AS A TRACER.

University Coll. of North Wales, Menai Bridge. Marine Science Labs.

For primary bibliographic entry see Field 2L.

W77-09347

PRECIPITATION LOADING OF ACID AND HEAVY METALS TO A SMALL ACID LAKE NEAR SUDBURY (ONTARIO).

Fisheries and Marine Service, Nanaimo (British Columbia). Biological Station.

For primary bibliographic entry see Field 5A.

W77-09353

DISSOLVED AMINO ACIDS IN THE EQUATORIAL PACIFIC, THE SARGASSO SEA, AND BISCAYNE BAY.

Scripps Institution of Oceanography, La Jolla, Calif.

For primary bibliographic entry see Field 5A.

W77-09356

SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT.

Delaware Univ., Newark. Center for Remote Sensing.

V. Klemas, G. R. Davis, and R. D. Henry. Journal Water Pollution Control Federation, Vol. 49, No. 5, p 757-763, May 1977. 3 fig, 1 tab, 13 ref. NASA NAS5-20983.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

Descriptors: *Currents(Water), *Ocean currents, *Waste disposal, *Remote sensing, *Atlantic Ocean, *Satellites(Artificial), *Circulation, *Water circulation, *Ocean circulation, *Aircraft, *Dye releases, *Tracers, *Coasts, *Continental shelf, *Monitoring, *Water pollution, *Path of pollutants, *Oceans.
Identifiers: Current drogues.

The mounting interest in extracting oil and other resources from the continental shelf and continuing use of shelf waters for waste disposal is creating a need for cost-effective, synoptic means of determining currents and monitoring pollutants in the shelf regions. A satellite-aircraft-drogue approach was developed which employs remotely tracked expendable drogues together with satellite and aircraft observations of waste plumes and current tracers, such as dyes or suspended sediment. Tests conducted on the continental shelf and in Delaware Bay indicated that the system provides a cost-effective means of studying current circulation, oil slick movement, and ocean waste dispersion under a wide range of environmental conditions. (Sims-ISWS)
W77-09358

CONTROL OF WATER POLLUTION FROM CROPLAND: VOLUME II—AN OVERVIEW.
Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-09390

DESIGN PARAMETERS FOR ANIMAL WASTE TREATMENT SYSTEMS - NITROGEN CONTROL.
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W77-09393

SURVIVAL OF PATHOGENS IN ANIMAL MANURE DISPOSAL.
Minnesota Univ., St. Paul. Coll. of Veterinary Medicine.
S. L. Diesch, B. S. Pomeroy, and E. R. Allred.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 005.
Price codes: A07 in paper copy, A01 in microfiche.
Environmental Protection Agency Report No. EPA 670/2-73 051, August 1973. 135 p. R 802205.

Descriptors: *Pathogenic bacteria, *Waste disposal, *Model studies, *Slurries, *Sludge, *Temperature, *Cattle, *Minnesota, *Oxidation lagoons, *Waste treatment, *Farm wastes, *Water pollution sources.
Identifiers: Oxidation ditch, *Survival(Pathogens), *Leptospira pomona, *Salmonella typhimurium.

A laboratory model (1:10 scale) of an operational field oxidation ditch used in beef cattle production was utilized in survival and detection studies of *Leptospira pomona* and *Salmonella typhimurium*. Minnesota summer (20C) and winter (2C) temperatures, pH, and dissolved oxygen of field ditch manure slurry were simulated in laboratory model studies of manure slurry, effluent, and sludge. Maximum leptospiral survival times of 138 days (summer) and 18 days (winter) in the slurry were measured. *Salmonella* survival of 47 days in slurry and 87 days in sludge (winter), and 17 days in slurry (summer) were measured. Adequate laboratory cultural detection and isolation techniques were developed to measure survival. Findings from simulated studies in a second laboratory model were used to separate materials for recycling. (East Central)
W77-09402

THE RELEASE OF METAL IONS TO GROUND WATER BY SOILS.
Tuskegee Inst., Ala. Dept. of Plant and Soil Science.
N. C. Patel.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 759.
Price codes: A06 in paper copy, A01 in microfiche.
M.S. Thesis, August 2, 1974, 96 p., 25 fig., 32 tab., 63 ref., append. OWRD B-028-ALA(6), 14-31-0001-3053.

Descriptors: Metals, *Adsorption, Retention, *Organic matter, Groundwater, Leaching, Ions, Soil types, *Cation exchange, Hydrogen ion concentration, *Calcium, *Barium, *Chromium, *Soil chemistry, *Path of pollutants, *Water pollution.
Identifiers: *Metal ions.

Muck, Hoytville, Nebraska, Norfolk, and Troup soils which differ in genesis, organic matter content, pH, and cation exchange status were used to study the adsorption of calcium, barium, and chromium. The study was conducted by metal equilibration treatments to isolate observable fractions of complexed metals: exchangeable, chelated, and non-displaceable. The total adsorption of calcium ions in these soils was observed to be in order of Muck>Norfolk>Hoytville>Nebraska>Troup soil. The order of total adsorbed barium was Muck>Hoytville>Nebraska>Troup>Norfolk. The order of total adsorbed chromium was the same as for barium. The Muck soil indicates a higher tenacity to adsorbed metallic cations than the other four soils, because it contains a higher percent of organic matter; it is more acidic and has a higher cation exchange capacity than the other four soils. The magnitude of the average stability constants for the soil-metal complexes are in the order of Muck>Hoytville>Nebraska>Norfolk>Troup soil. This indicates that relative stability of resulting soil-metal complexes increases with increase in organic matter. The results of these studies may be used to explain the high leachability of metal ions from certain soils or to predict which of the metal ions would be adsorbed to the least extent by a given soil. These results indicate that, if soils of high organic matter content, high acidity, and high cation exchange capacity are equilibrated with cations of high electronegativity and high valences, the values of the stability constants will be high for these soils.
W77-09405

THE EFFECTS OF THERMAL DISCHARGE AND ARTIFICIAL AERATION ON STREAM WATER QUALITY.
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
For primary bibliographic entry see Field 5G.
W77-09407

NITRATE-NITROGEN MOVEMENT THROUGH SOIL AS AFFECTED BY SOIL PROFILE CHARACTERISTICS.
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
D. Devitt, J. Letey, L. J. Lund, and J. W. Blair.
Journal of Environmental Quality, Vol. 5, No. 3, p. 283-288, July-September 1976. 4 fig., 2 tab., 14 ref.

Descriptors: *Nitrogen, Soil investigations, *Manganese, Chlorides, Denitrification, Leaching, *Irrigation practices, *Eutrophication, *Oxidation-reduction potential, *Nitrates, *Soil water movement, *Path of pollutants, *Agricultural runoff.
Identifiers: *Nitrate-Nitrogen.

The contribution of agricultural practices to pollution of ground and surface waters by nitrogen is not completely known. Six tile systems installed on commercial farms with differing soil profile characteristics were selected for investigation. Soil solution samples were extracted from 61-, 91-, 122-, and 183 cm depths and analyzed for nitrate-nitrogen, manganese, and chloride concentra-

tions, and electrical conductivity. Redox potential measurements were made at 91- and 183-cm depths. Tensiometers were installed at 61-, 91-, and 122-cm depths to measure hydraulic gradients. Tile effluent samples were also collected and analyzed. Data on redox potential, manganese concentrations, and nitrate-nitrogen concentration and movement were dependent on water movement and amounts of nitrate available for leaching. Irrigation management to provide low leaching fraction resulted in relatively higher nitrate-nitrogen concentration in the tile effluent but smaller amounts of total nitrate lost as compared to irrigation management for high leaching fractions. Redox potentials and the chloride to nitrate-nitrogen ratios indicated that subsurface layers of high clay content promote denitrification. With one exception, a smaller fraction of the applied nitrogen was lost in the tile effluent from profiles containing layers of high clay content as compared to the coarse-textured profiles. (Skogerboe-Colorado State)
W77-09427

NITRATE LEAKAGE FROM SOILS DIFFERING IN TEXTURE AND NITROGEN LOAD.
Technion - Israel Inst. of Tech., Haifa. Lab. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09428

SOIL NITRATES FOLLOWING FOUR YEARS CONTINUOUS CORN AND AS SURVEYED IN IRRIGATED FARM FIELDS OF CENTRAL AND EASTERN COLORADO.
Colorado State Univ., Fort Collins. Dept. of Agronomy.
A. E. Ludwick, J. O. Reuss, and E. J. Langin.
Journal of Environmental Quality, Vol. 5, No. 1, p. 82-86, January-March 1976. 4 fig., 3 tab., 18 ref.

Descriptors: *Fertilizers, *Nitrogen, *Groundwater, Pollutants, Corn(Field), Irrigation effects, *Colorado, Fertilization, Nutrients, Soil texture, Beans.
Identifiers: Nitrate pollution, Irrigation management.

High rates of fertilizer N used in many intensive farm management systems have been cited as a potential hazard to surface and ground waters. The purpose of this study was to evaluate soil NO₃(-) accumulations following 4 years continuous corn grown with different nitrogen and irrigation regimes, and to compare these results to present NO₃(-) concentrations found in irrigated farm fields of central and eastern Colorado. Soil NO₃(-) content in the 300-cm sampled profile was significantly influenced by both fertilizer N and irrigation treatments; the greater accumulations were associated with the two higher fertilizer N rates and two lower irrigation rates. Nitrate increased linearly in relation to fertilizer N between 67 and 269 kg N/ha and could be described by two simple regression equations separating the irrigation treatments into two groups (1-2 and 1-3, low rates; 1-4 and 1-5, high rates). Coefficients of determination for the two groups were 0.981 and 0.975, respectively. (Skogerboe-Colorado State)
W77-09429

NITRATE DYNAMICS IN FALL CREEK, NEW YORK.
Pennsylvania Univ., Philadelphia. Regional Planning Div.
A. H. Johnson, D. R. Bouldin, E. A. Goyette, and A. M. Hedges.
Journal of Environmental Quality, Vol. 5, No. 4, p. 386-391, October-December 1976. 5 fig., 3 tab., 11 ref.

Descriptors: *Watersheds(Basins), *New York, Leaching, Water quality, Farm wastes, Agriculture, *Nitrates, *Path of pollutants, Monitoring.
Identifiers: Growing season, Nitrate loss, Drinking water, Nonpoint sources, *Fall Creek(NY).

Nitrate loss from a 330 sq km rural watershed in central New York was monitored over a 31-month period. Seasonal N03-N patterns were well defined with highest levels in the winter and lowest levels in the summer resulting from accumulation of N03-N in the soil profile during the growing season and leaching during the winter months. Stream water at the outlet of the watershed studied is used as a source of drinking water for some 20,000 people. Nitrate-N concentrations at the drinking water intake currently do not exceed 3 mg/liter. Human activities affected N03-N levels, with dairying and sewage being the major contributors. If agriculture is expanded to its maximum acreage, keeping the present ratio of corn/hay/pasture/people, N03-N levels at the drinking water intake will not exceed present standards for drinking water. (Skogerboe-Colorado State).

W77-09431

BEHAVIOR OF CHROMIUM IN SOILS: I. TRIVALENT FORMS,
Vermont Univ., Burlington. Dept. of Plant and Soil Science.

For primary bibliographic entry see Field 2G.
W77-09432

THE INFLUENCE OF APPLIED PHOSPHORUS, MANURE, OR LIME ON UPTAKE OF LEAD FROM SOIL,
Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
R. L. Zimdahl, and J. M. Foster.
Journal of Environmental Quality, Vol. 5, No. 1, p 31-34, January-March 1976. 3 tab, 17 ref.

Descriptors: *Lead, *Corn(Field), *Phosphorus, *Lime, Heavy metals, Soil investigations, Translocation, Soils, Farm wastes.
Identifiers: Lead pollution.

Studies of the uptake of lead from soil by corn have shown that soil applications of phosphorus (CatH2P04/2 H2O) decrease uptake, but translocation was affected and at higher lead levels. Lead uptake decreased when cow manure was added to attain a total organic content of 6%, but there was no effect of additional manure. Liming did not have a consistent effect on uptake, but lead translocation appeared to decrease with liming. The addition of phosphorus was not an agronomically feasible way to reduce the effects of lead contamination, but additions of manure and lime offered promise of reducing lead uptake. (Skogerboe-Colorado State)

W77-09435

FATE OF FERTILIZER NITROGEN IN A FLOODED RICE SOIL,
Louisiana State Univ., Baton Rouge. Lab. of Flooded Soils and Sediments; and Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09438

ADSORPTION OF SELENITE AND PHOSPHATE ON AN ALLOPHANE CLAY,
Ruakura Agricultural Research Center, Hamilton (New Zealand). Soil Chemistry Group.
For primary bibliographic entry see Field 2G.
W77-09439

HETEROVALENT CATION EXCHANGE EQUILIBRIA IN SOILS WITH VARIABLE AND HETEROGENEOUS CHARGE,
California Univ., Davis. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-09440

PHOSPHORUS FERTILIZATION WITH DRIP IRRIGATION,
California Univ., Davis. Dept. of Land, Air, and Water Resources.
For primary bibliographic entry see Field 3F.
W77-09443

CONCENTRATION AND DISTRIBUTION OF ELEMENTS IN PLANTS AND SOILS NEAR PHOSPHATE PROCESSING FACTORIES, POCATELLO, IDAHO,
Geological Survey, Denver, Colo.
R. C. Severson, and L. P. Gough.
Journal of Environmental Quality, Vol. 5, No. 4, p 476-482, October-December 1976. 5 fig, 4 tab, 19 ref.

Descriptors: *Idaho, *Phosphates, *Shales, Soils, *Sagebrush, Sediments, Nickel, Trace elements, Water pollution sources, Vegetation.
Identifiers: Phosphate processing factories, Selum, Pocatello(Idaho).

The processing of phosphatic shale near Pocatello, Idaho has a direct influence on the element content of local vegetation and soil. Samples of big sagebrush and cheatgrass show important negative relations between the concentration of certain elements (Cd, Cr, F, Ni, P, Se, U, V, and Zn) and distance from phosphate processing factories. Plant tissues within 3 km of the processing factories contain unusually high amounts of these elements except Ni and Se. Important negative relations with distance were also found for certain element (Be, F, Fe, K, Li, Pb, Rb, Th, and Zn) in A-horizon soil. Amounts of seven elements (Be, F, Li, Pb, Rb, Th, and Zn) being contributed to the upper 5 cm of the soil by phosphate processing, as well as two additional elements (U and V) suspected as being contributed to soil, were estimated, with F showing the greatest increase (about 300 kg/ha) added to soils as far as 4 km downwind from the factories. The greatest number of important relations for both plants and soils was found downwind (northeast) of the processing factories. (Skogerboe-Colorado State)

W77-09444

INFLUENCE OF PESTICIDES ON DENITRIFICATION IN SOIL AND WITH AN ISOLATED BACTERIUM,
Pennsylvania State Univ., University Park. Dept. of Soil Microbiology.
J.-M. Bollag, and N. M. Henninger.
Journal of Environmental Quality, Vol. 5, No. 1, p 15-18, January-March 1976. 2 fig, 3 tab, 8 ref.

Descriptors: *Pesticides, *Denitrification, Insecticides, Inhibition, Fungicides, Herbicides, Anaerobic conditions, Soils.
Identifiers: Bacterium, *Denitrifying bacterium, Nitrate reduction.

Various pesticides were tested for their influence on the denitrification process in soil and on an isolated denitrifying bacterium. In soil the denitrifying activity was essentially inhibited by the fungicides captan, maneb, and nabam, and to a lesser extent by the herbicide 2,4-D. In pure culture studies with a bacterium whose end product in denitrification was nitrous oxide, the fungicides also caused strong inhibition of the respiratory nitrate reduction process; the insecticide carbaryl, the phenylurea herbicides, 2,4-D and propanil (isopropyl carbanilate) also functioned as inhibitors, but to a lesser extent. The inhibition by certain pesticides influenced the formation rate of nitrite and sometimes prevented the reduction of accumulated nitrite during incubation under anaerobic conditions. (Skogerboe-Colorado State)

W77-09445

SIMPLIFIED LONG TERM CONCEPT FOR EVALUATING LEACHING OF NITROGEN FROM AGRICULTURAL LAND,
Joint FAO/IAEA Div. of Atomic Energy in Agriculture, Vienna (Austria).
M. Fried, K. K. Tanji, and R. M. Van De Pol.
Journal of Environmental Quality, Vol. 5, No. 2, p 197-200, April-June 1976. 5 fig, 1 tab, 17 ref.

Descriptors: *Leaching, *Nitrogen, *Crop production, *Groundwater, Water quality, Pollutants, Fertilizers, Nutrients, Evaluation, *Path of pollutants, Water pollution.

A rather simple concept is proposed for predicting the contribution of crop production practices to groundwater N pollution. It is a steady state long term concept. One of the consequences is that the myriad reactions that take place in the soil body itself need not be evaluated. Application of this concept indicates that, in general, the most important practice under man's control that affects potential pollution is fertilizer use efficiency. As long as yield response is obtained to N fertilizer additions, fertilizer should contribute lesser amounts of N to the groundwater providing fertilizer use efficiency is maintained at a high level. (Skogerboe-Colorado State)

W77-09446

METHYLATION OF MERCURY IN AGRICULTURAL SOILS,
Environmental Protection Agency, Las Vegas, Nev. Office of Research and Development.
For primary bibliographic entry see Field 2G.
W77-09447

POTENTIAL ENVIRONMENTAL IMPACTS FROM THE PRODUCTION OF SYNTHETIC FUELS FROM COAL.
Organization for Economic Co-Operation and Development, Paris (France).
Environment Directorate 32091, 1977. 54 p, 7 tab, 11 ref, 2 append.

Descriptors: *Water pollution sources, *Coals, *Environmental effects, Industrial wastes, International commissions, Fuels, Air pollution, Solid wastes, Pollutants.
Identifiers: *Coal gasification, *Coal liquification, Synthetic fuels, Organization for Economic Cooperation and Development.

As part of a study to provide member governments of the Organization for Economic Cooperation and Development with policy options or guidelines to prevent or minimize environmental conflicts, impacts of coal conversion to liquid or gas form are reviewed. Discussed are the different technologies needed to convert coal to oil and coal to gas, the resources needed to switch to coal conversion, the economics of the conversion processes, potential environmental impacts that must be controlled at conversion plants, the current state of control technology involved in the processes, and the method of measuring tradeoffs among residuals for evaluation purposes and for site selection. Appendices include flow sheets for the major coal conversion processes and descriptions of the following coal gasification processes: (1) Lurgi low-calorific processes; (2) Koppers-Totzek process; (3) Lurgi high-calorific value process; (4) HYGAS process; (5) BI-GAS process; (6) Synthane process; (7) Bureau of Mines stirred fixed-bed process; and (8) carbon dioxide acceptor process. Five coal liquification processes are also described: (1) Synthoil process; (2) H-Coal process; (3) Solent refined process; (4) COED process; and (5) Fischer-Tropsch process. Specific environmental impact tradeoffs, however, are not given for the individual conversion processes. (Harris-Wisconsin)

W77-09458

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

TECHNICAL AND MICROECONOMIC ANALYSIS: ARSENIC AND ITS COMPOUNDS, Versar, Inc., Springfield, Va. R. P. Burruss, and D. H. Sargent. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 980, Price codes: A11 in paper copy, A01 in microfiche. Report No. EPA 560/6-76-016, April 1976. 240 p, 8 fig, 46 tab, 159 ref. 68-01-2926.

Descriptors: *Arsenic compounds, *Pollutant identification, Arsenicals(Pesticides), Water pollution sources, Toxicity, Air pollution, Industrial production, Industrial wastes, Effluents, Water pollution effects, Public health, Soils, Sediments, Freshwater, Oceans, Phosphates, Air pollution effects, Economic impact, Costs, Feasibility, Estimated costs.

Identifiers: Arsenic pollution.

The role of arsenic and its compounds in the environment as well as in the U.S. economy was studied to evaluate the need for and the projected effect of controlling its production, use, dissipation, and emission. Arsenic occurrence, chemistry, and toxicology are reviewed; its prevalence as an impurity in commercial raw materials, processes, and products is documented; the commercial flow of arsenical products is quantified; the sources of pollution are identified and characterized; and its health hazards are evaluated. Except for arsenic in phosphate detergents, and a small loss via copper smelter wastewaters, the waterborne effluents of arsenic were found to be virtually zero. Arsenic ingested through food, even in high concentrations in some sea foods, does not constitute an identifiable health threat, nor does arsenic in water. Municipal waste treatment plants effectively reduce the arsenic content of raw water, arsenic in fresh waters becomes locked into highly insoluble soil or sediment complexes, or it moves to the oceans, and very few public water supplies exceed the recommended standard. Present controls were felt to be adequate in these areas. Serious problems were found to exist, however, from arsenic emissions to the air, particularly from high-temperature processes. (Luedtke-Wisconsin)

W77-09465

EVALUATION OF PETROLEUM-DEGRADING POTENTIAL OF BACTERIA FROM WATER AND SEDIMENT, Maryland Univ., College Park. Dept. of Microbiology. J. D. Walker, R. R. Colwell, and L. Petrakis. Applied Microbiology, Vol. 30, No. 6, p 1036-1039, 1975. 2 fig, 2 tab, 9 ref.

Descriptors: *Oil spills, *Oil pollution, *Microbial degradation, *Bacteria, Aquatic bacteria, Soil bacteria, Biodegradation, *Maryland, Pseudomonas, Oxidation, Evaluation.

Identifiers: Colgate Creek(Md), Baltimore Harbor(Md), Acinetobacter, South Louisiana crude oil.

The relative efficiency of oil degradation by *Pseudomonas* and *Acinetobacter* bacteria in soil and in water was tested with South Louisiana crude oil and Colgate Creek water in Baltimore Harbor, which is continuously exposed to accidental oil spills and where oil also reaches the sediment in the shallows. The results indicated that bacteria in the water column possess a greater degradation capacity than sediment bacteria. Resins and asphaltene increased to a greater extent as a result of the water bacteria degradation than from sediment bacteria. Although sediment bacteria removed greater quantities of saturated hydrocarbons than occurred by weathering, water bacteria removed significantly more 2-, 3-, 4-, 5-, and 6-ring cycloalkanes than the sediment bacteria. Cycloalkanes were degraded to a lesser extent as the ring number increased from 1 to 4 but as the ring number increased from 4 to 6, they were more susceptible to degradation. Weathering did not remove any of the aromatics but the water bacteria

were more effective than sediment bacteria in degrading them. Sulfur added to an aromatic hydrocarbon reduced its degradation potential by the water bacteria. Addition of an alicyclic ring(s) to an aromatic ring and the position of an alicyclic ring between two aromatic rings (fluorenes) alters its biodegradability. Several conjectures are offered as to why sediment bacteria are less effective in degrading crude oil hydrocarbons than water bacteria. (Auen-Wisconsin)

W77-09472

SURVEY OF INDUSTRIAL PROCESSING DATA. TASK I-HEXACHLOROBENZENE AND HEXACHLOROBUTADIENE POLLUTION FROM CHLOROCARBON PROCESSING, Midwest Research Inst., Kansas City, Mo. C. E. Mumma, and E. W. Lawless. Available from the National Technical Information Service, Springfield, VA 22161 as PB-243 641, Price codes: A09 in paper copy, A01 in microfiche. Report No. EPA 560/3-75-003, June 1975. 186 p. 28 fig, 26 tab, 50 ref, 3 append. EPA 68-01-2105.

Descriptors: *Chemicals, *Water pollution sources, *Chemical wastes, *Industrial wastes, Chlorides, Chemical industry, Industrial production, Toxins, Toxicity, Poisons, Waste disposal, Monitoring, Chlorinated hydrocarbon pesticides, Byproducts.

Identifiers: *Hexachlorobenzene, *Hexachlorobutadiene, Perchlorobenzene, Hydrocarbons.

An evaluation of the potential for environmental contamination by hexachlorobenzene (HCB) and hexachlorobutadiene (HCBd) recommends that on-site monitoring be conducted at 10 specific industrial plants in the United States where production and processing of perchloroethylene, trichloroethylene and carbon tetrachloride are included in the manufacturing processes; these chlorocarbons account for an estimated 89% of the HCB and 99% of the HCBd produced in this country. HCB is a stable and potentially hazardous environmental pollutant highly resistant to chemical, biological and physical degradation. Single-dose acute toxicity is very low, but subacute or chronic toxicity can be significant. HCBd is also a stable environmental pollutant, and has greater acute toxicity than HCB. One of the most effective and safest methods for disposing of wastes containing HCB and HCBd involves use of a specially-designed high temperature incineration system. Some deep-well injection and landfill disposal methods are still being used, but these are not preferred. The study also included evaluations of 21 additional domestically-produced chemicals which were known sources of HCB and/or HCBd or were theoretically capable of generating these substances as by-products, waste materials or impurities in a commercial product. (Harris-Wisconsin)

W77-09475

MINERALOGICAL COMPOSITION OF SUBMERGED AQUATIC MACROPHYTES FROM CONNECTICUT, For primary bibliographic entry see Field 5A.

W77-09477

COLUMBIA RIVER NUTRIENT STUDY-1972, Environmental Protection Agency, Seattle, Washington. Surveillance and Analysis Div. For primary bibliographic entry see Field 5C.

W77-09504

DEGRADATION OF PARATHION IN SEAWATER, Institut fuer Meeresforschung, Bremerhaven (West Germany). K. Weber. Water Research, Vol. 10, No. 3, p 237-241, 1976. 4 fig, 2 tab, 9 ref.

Descriptors: *Organophosphorus pesticides, *Degradation(Decomposition), *Sea water, Chemical degradation, Biodegradation, Pesticide residues, By-products, Mode of action, Microbial degradation.

Identifiers: *Parathion.

Decomposition of the organophosphate parathion in seawater was investigated by measuring the degradation time and detection of degradation products. After one year at room temperature in seawater, an average 20% of the initial amount of parathion had not been degraded. The degradation process is mainly accomplished by two ways: chemical hydrolysis and biological decomposition. After 95% decomposition of parathion neither the oxidation product, paraoxon nor the isomerization product, isoparathion, could be detected. The chemical hydrolysis proceeds, first, via dearylation with loss of p-nitrophenol, then through dealkylation leading to a secondary ester of phosphoric acid which still contains the p-nitrophenyl moiety, i.e., deethylparathion. Deethylparathion is saponified in aqueous solutions of potassium hydroxide to yield p-nitrophenolate. Hydrolysis to p-nitrophenol is favored through high hydrogen ions and hydroxide anion-activity, whereas the second hydrolytic pathway is mainly observed in neutral media. Slowly growing amounts of p-nitrophenol after complete degradation prove that primary hydrolysis products are further hydrolyzed. The reaction rate is strongly dependent on water temperature. Parathion is degraded mainly through chemical means as biodegradation is restricted by the pesticide's damage to aquatic organisms. Its degradation product, p-nitrophenol is reduced by microorganisms and further chemically changed to not yet identified substances. The second hydrolytic product, deethylparathion, is resistant to biodegradation or to chemical hydrolysis; its toxicity is unknown. (Auen-Wisconsin)

W77-09506

NEW MEDIUM FOR ISOLATING IRON-OXIDIZING AND HETEROTROPHIC ACIDOPHILIC BACTERIA FROM ACID MINE DRAINAGE, Environmental Monitoring and Support Lab., Cincinnati, Ohio. H. L. Manning. Applied Microbiology, Vol. 30, No. 6, p 1010-1016, 1975. 7 fig, 1 tab, 6 ref.

Descriptors: *Acid bacteria, *Iron bacteria, Cultures, Laboratory tests, *Mine drainage, Water pollution control.

Identifiers: Iron bacteria medium.

A newly-developed medium which combines ferric sulfate, basal salts and Purified Agar L28, for growing iron and acid mine water bacteria, is described. Purified agar produces a firm gel at low concentrations (0.7%) and allows good growth of iron-oxidizing cells. To obtain gelation of the medium, the agar must be autoclaved in distilled water separately from the acid (pH 3.0) salts solution. The basic salts solution of the medium does not contain potassium phosphate as that prevents growth of iron colonies. Apparently the purified agar supplies enough phosphorus to support growth of the cells. The ferric sulfate solution contains the oxidizable energy source of ferrous iron. Details for preparation of the medium are given. Examination of acid mine water from five states revealed several kinds of colonies of iron-oxidizing bacteria, including (1) smooth, (2) smooth with secondary growth sectors or branching, (3) star-shaped, (4) radiating lobe, and (5) flat-rough. All acid mine drainage samples yielded whitish colonies that could not use ferrous iron, sulfur, or hydrogen, nor could they grow on nutrient agar, brain heart infusion agar, or Trypticase soy agar. Glucose and sucrose supported growth if the sugar-salts medium was at pH 3.0. This new iron bacteria medium is easy to prepare, induces rapid growth and larger colonies, and allows differentiation of colony morphology and detection of new acidophilic bacteria. (Auen-Wisconsin)

W77-09511

USER'S MANUAL FOR THE M.I.T. TRANSIENT WATER QUALITY NETWORK MODEL—INCLUDING NITROGEN-CYCLE DYNAMICS FOR RIVERS AND ESTUARIES, Massachusetts Inst. of Tech., Cambridge, Dept. of Civil Engineering.
D. R. F. Harleman, J. E. Dailey, M. L. Thatcher, T. O. Najarian, and D. N. Brocard.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 925, Price codes: A12 in paper copy, A01 in microfiche. Report No. EPA-600/3-77-010, January 1977. 253 p. 30 fig, 15 tab, 12 ref, 3 append. 1BA608, EPA R800429.

Descriptors: *Nitrogen cycle, *Estuaries, *Rivers, *Computer models, Eutrophication, River basins, Model studies, Computer programs, Aerobic conditions, Nutrient requirements, Mass transfer, Dispersion, Cycling nutrients, Mathematical models, Hydrodynamics.
Identifiers: Mass transport.

The development and application of a real-time water quality model for estuarine ecosystems is described, in which a solution is provided for the one dimensional continuity and momentum equations to generate the temporal and spatial variations in the tidal discharges and elevations. The information is used in the solution of the conservation of mass equations for a large number of water quality parameters. The structure of the model is a closed-matter flow loop for nitrogen and is developed under the assumption that the dominant activity in the estuarine ecosystem is aerobic and that nitrogen alone limits the growth of organisms. The ecosystem model is coupled with a real-time hydrodynamic transport system as opposed to a tidal average or slack-tide approximation. The manual contains a review of the theoretical background of the model, a detailed discussion of the computer program including a complete algorithm an example of an application to hypothetical estuarine and river systems. The model's uniqueness lies in its application to properly specify mass transport due to changes in magnitude and direction of flow with time in tidal systems. It is intended for use in engineering decisions regarding the degree of eutrophication due to distributed and point-source loadings in estuaries. (Harris-Wisconsin).
W77-09519

THERMAL CONDUCTIVITY OF ORGANIC SEDIMENTS FROM TWO WISCONSIN LAKES, Cold Regions Research and Engineering Lab., Hanover, N.H. Earth Sciences Branch.
For primary bibliographic entry see Field 2J.
W77-09521

BIODEGRADATION OF CELLULOSIC SUBSTRATES, Louisiana State Univ., Baton Rouge.
S. P. Meyers.
Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-026 401, Price codes: A02 in paper copy, A01 in microfiche. Report to Office of Naval Research, June 1976. 14 p. NR 306-087. N0014-69-A-0211-0006.

Descriptors: *Waste disposal, *Cellulose, *Biodegradation, *Fibers(Plant), Mass wasting, Degradation(Decomposition), Oceans, Estuaries, Ships, Marine microorganisms, Oil, Polychlorinated biphenyls, Microbial degradation.
Identifiers: Accelerated cellulolysis, Marine pollution.

Investigations seeking ways to accelerate biodegradation of cellulotics (Kraft paper, cardboard, and other highly processed fibers) in relation to disposal of shipboard wastes in the marine environment developed methodologies to enumerate cellulolytic bacteria, to characterize cellulose breakdown, and to analyze optimal pretreat-

ment of cellulotics to hasten degradation. Cellulose biotransformation rates were determined, along with analyses of these rates in pristine and hydrocarbon-polluted waters. Cellulolytic activities of specific molds and yeasts, with emphasis on beta-glucosidase systems, and their role in cellular breakdown were analyzed. PCB levels in various cellulotics were established with analyses of concentration and removal methodology correlated to cellulose biodegradation. The effect of hydrocarbon levels on microbial processes was examined with particular attention given to rates of cellulose turnover in the environment and the effect on microbial diversity in stressed environments. Cellulose pretreatments that appeared most promising include an alkali treatment of pre-shredded cellulose as well as a nitrite photochemical treatment (a combination of sodium nitrite solution and ultraviolet irradiation). The latter process may be especially suitable for shipboard usage in that nitrite levels probably are already high in detergent-loaded waste waters. (Auen-Wisconsin)
W77-09522

POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN, Environmental Protection Agency, Washington, D.C. Water Quality Office.
For primary bibliographic entry see Field 5G.
W77-09528

POLLUTION OF THE INTERSTATE AND INTRASTATE WATERS OF THE UPPER MISSISSIPPI RIVER AND ITS TRIBUTARIES.
For primary bibliographic entry see Field 5G.
W77-09529

5C. Effects Of Pollution

THE EFFECT OF LEACHATE FROM WESTERN RED CEDAR, THUJA PLICATA DONN, ON AQUATIC ORGANISMS, Washington Univ., Seattle. Cooperative Fisheries Unit.
G. B. Peters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 503, Price codes: A09 in paper copy, A01 in microfiche. M.S. Thesis, 1974. 170 p, 33 fig, 13 tab, 57 ref, 2 append. OWRT C-5336(No. 4223)(1), 14-31-0001-4223.

Descriptors: *Acid streams, *Salmonids, *Water pollution sources, Clear-cutting, Reforestation, Organic acids, Decomposing organic matter, Aquatic insects, Aquatic productivity, Drainage effects, Soil chemistry, Path of pollutants, Acidic soils, Lysimeter, Wood wastes, *Leachate, *Washington, Lethal limit, Toxicity, Water pollution effects, Chromatography.
Identifiers: *Gel permeation chromatography, *Cedar leachates, *Quinault Indian Reservation(Wash), High water tables.

The toxicities of cedar extractives originating from heartwood, bark, and foliage to various aquatic organisms have been determined in laboratory bioassays. The interactions of various modifying factors were also investigated with tropolones, the most toxic cedar compounds. Temperature, iron concentration, and degree of prior exposure of test organisms have a large effect on the toxicity of tropolones, while variations in genetic stock and pH of the water had no effect. Tropolones have never been identified within stream samples at concentrations that have been acutely toxic in the laboratory bioassays. The TOC of stream samples also indicates that other cedar extractives are unlikely to be in sufficient quantities to be toxic. The most acute condition identified on the Quinault Reservation has been the high acidity of most of the streams. Lethal conditions were recorded within the tributaries of several reservation streams for periods in excess of six months.

Seasonal changes in rainfall have a direct influence on the toxic conditions that exist in these tributaries and the great depression in pH that characteristically occurs within the major streams. The extensive logging on the reservation is believed to be at least partially responsible for the high acidity of the streams. The exact contribution that logging has made will be more accurately assessed after more knowledge on the origin of stream acidity has been gained.
W77-09101

CHANGES IN THE HABITAT CONDITIONS OF ANIMALS IN THE VOLGA DELTA ASSOCIATED WITH THE IMPLEMENTATION OF THE VOLGOGRAD HYDROELECTRIC STATION, (IN RUSSIAN), For primary bibliographic entry see Field 6G.
W77-09102

HYDROOPTICAL AND HYDROBIOLOGICAL INVESTIGATIONS OF THE CENTRAL PARTS OF THE RESERVOIR OF THE KRASNOYARSK HYDROELECTRIC STATION, (IN RUSSIAN), Akademiya Nauk USSR, Krasnoyarsk. Inst. of Agrochemistry and Soil Sciences.
F. Ya. Sid'Ko, L. A. Shchur, N. A. Frank, and A. D. Aponasenko.
IZV Sib Otd Adad Nauk Sssr Ser Biol Nauk 1, p 45-49, 1976.

Descriptors: *Reservoirs, *Chlorophyll, *Phytoplankton, *Light penetration, Hydrobiology, Density, Biomass, Opacity.
Identifiers: Hydrooptics, Krasnoyarsk, USSR(Krasnoyarsk reservoir), Spectra.

Studies were carried out on horizontal and vertical chlorophyll distribution, number, biomass and specific composition of phytoplankton in the middle parts of the Krasnoyarsk reservoir (Russian SFSR, USSR). Spectra of the (light) attenuation in these regions were obtained.—Copyright 1977, Biological Abstracts, Inc.
W77-09136

THE EFFECTS OF THREE HERBICIDES ON LARVAE OF THE PHANTOM MIDGE, CHAOBORUS PUNCTIPENNIS (SAY), Tennessee Univ., Knoxville. Dept. of Zoology.
G. K. Eddlemon.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 343, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, June 1974. 61 p, 5 fig, 11 tab, 41 ref. OWRT A-028-TENN(2).

Descriptors: *Larvae, *Herbicides, Water pollution effects, Plankton, *2,4-D, *Midges, Aquatic insects, *Aminotriazole, *Diptera, *Tennessee, *Toxicity, Mortality, Reservoirs, Amino acids.
Identifiers: *Chaoborus punctipennis, 2,4-D amine no. 4, Ortho brush killer A, Amino triazole weed-killer, *Lake Loudoun(Tenn).

The third and fourth instar larvae of *Chaoborus punctipennis*, planktonic dipterans important both as predators and prey in lakes and reservoirs, were subjected to static tests of various concentrations of three commercial herbicides: Chippmans 2,4-D Amine No.; Ortho Brush Killer A, and Amino Triazole Weedkiller. Larvae and dilution water were collected from Lake Loudoun Reservoir, Knox County, Tennessee. Observations of larval response (immobilization) were conducted every six hours for the first 48 hours of each test and every 12 hours for at least the next 48 hours. A toxicity curve was constructed for each test by plotting time to 50 percent response against concentration. The 96 hour (100 hour) IC50 values for 2,4-D and ammonium sulfate herbicides at 15 C were 890 ppm and 3430 ppm, respectively—concentrations far higher than likely to be encountered in natural environment. The toxicity of ammonium sulfate appeared to interact signifi-

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Group 5C—Effects Of Pollution

cantly with temperature, however, as IC50 values at 20 C generally ran about half those at 15 C. Although computer analysis of data from amirrole tests produced no significant regressions of response on concentration, this herbicide is considered potentially the most hazardous of the three herbicides to Chaoborus populations. Larval response to test solutions as low as 5.6 ppm was always much greater than response in control. Furthermore, an adult emergence-suppression threshold seemed to exist between 18 and 56 ppm. W77-09139

THE ACUTE TOXICITY OF FOUR HERBICIDES TO 0-4 HOUR NAUPLII OF THE COPEPOD CYCLOPS VERNALIS FISHER, Tennessee Univ., Knoxville. Dept. of Zoology. E. B. Robertson, Jr.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 495. Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, March 1975. 70 p, 10 fig, 11 tab, 42 ref, 2 append. OWRT A-028-TENN(3).

Descriptors: *Herbicides, *Toxicity, *Copepods, Water pollution effects, *Mortality, *2,4-D, *Aminotriazole, *Lethal limit, Amino acids, Microscopy. Identifiers: *Nauplii, Alkanoamine, Seriology, *Acute toxicity.

Nauplii (0-4 hours old) of the copepod Cyclops vernalis Fisher were exposed to a series of doses of amirrole, amirrole-T, 2,4-D (free acid), and the alkanolamine salt of 2,4-D in a standard test medium. The tests had a duration of 96 hours with observations at 12-hour intervals. Mortality was determined by failure of the animals to respond to tactile stimulation. Time to 50 percent mortality and the 48- and 96-hour LD50's were calculated by computer using a program of probit analysis. The nauplii were much more susceptible to amirrole-T than to amirrole. The incipient lethal levels for amirrole and amirrole-T were 22.1 and 2.32 ppm respectively. The free acid of 2,4-D was more toxic to the nauplii than was the alkanolamine salt. The incipient lethal level was 8.72 ppm for the free acid and 142.0 ppm for the salt. Seriological microtiter plates were adapted for use as test containers to allow microscopic examination of the nauplii. The plates were quite satisfactory containers as control survival exceeded 96 percent for all control animals used. W77-09142

A BACTERIAL WATER QUALITY INVESTIGATION OF CANYON LAKE, ARIZONA, Arizona Univ., Tucson. Dept. of Watershed Management. W. F. Horak.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 360. Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1974. 54 p, 9 fig, 3 tab, 34 ref. OWRT A-053-ARIZ(1), 14-31-0001-5003.

Descriptors: Water quality, Recreation, *Arizona, Lakes, *Bacteria, Bacteriology, Water pollution, *Coliforms, Regression analysis, Pollution abatement, Sites. Identifiers: *Recreational waters, *Bacteriological pollution, Prediction models, Central Arizona, *Canyon Lake(Ariz).

A study was made on Canyon Lake to determine the source of fecal contamination and to learn how best to control the contributing sources. Of all the water samples taken from the Acacia swimming area, 5.3% exceeded the recommended standard of 200 fecal coliforms per 100 ml water. Bacterial levels determined for 24 sediment samples from the Acacia area were mostly in the thousands per 100 ml range. Fecal coliform-fecal streptococci ratios for both the water and sediment samples were predominately in the range where animal waste is the presumed source. A hypothesis is

presented which implicates sediment-stored bacteria as the major immediate source of water pollution with human users and dogs as the ultimate sources. Bacterial survival data are presented showing how the fecal coliform-fecal streptococci ratio will shift with storage until, after one week, a ratio typical of human pollution will decrease to one indicative of contamination by animal wastes. Multiple regression analysis was employed to define the relationships between bacterial levels and site conditions and area use. User load index (car count) and/or turbidity were significantly correlated with fecal coliform count in most of the various regressions. This correlation over all data was about 50 percent. W77-09150

PHOSPHATE AND TRIPOLYPHOSPHATE ADSORPTION BY CLAY MINERALS AND ESTUARINE SEDIMENTS, Virginia Inst. of Marine Science, Gloucester Point. C. A. Lake, and W. G. MacIntyre.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 318. Price codes: A04 in paper copy, A01 in microfiche. Va. Water Resources Research, Blacksburg Bulletin 109, June 1977. 58 p, 4 fig, 23 tab, 56 ref. OWRT A-072-VA(1).

Descriptors: *Phosphates, Clays, Sediments, Nutrients, *Estuarine environment, *Adsorption, *Clay minerals, *Virginia, Estuaries, Salinity, Temperature, Hydrogen ion concentration, Water pollution effects. Identifiers: Clay sediments, Factorial analysis, *Orthophosphates, *Triphosphates.

This investigation sought to provide additional needed information on overenrichment of estuarine areas by examining the extent to which phosphate nutrients are taken up by clay sediments in estuarine and marine environments. Examined specifically was the adsorption of orthophosphate and triphosphate by the four clay minerals most commonly found in Virginia estuaries. A factorial analysis was applied to the design of the experiments in order to examine statistically the effect of pH, salinity, temperature, and initial phosphate concentration on orthophosphate adsorption. The main effects of pH and initial phosphate concentration were statistically important to orthophosphate adsorption. The amount of orthophosphate adsorbed by each of the clays increased in the following order: montmorillonite < kaolinite < illite < chlorite. The orthophosphate adsorption by synthetic clay demonstrated the generality of the adsorption experiments, for similar amounts were adsorbed by both synthetic and natural clays. When the source of phosphorus was triphosphate rather than orthophosphate, each clay absorbed more phosphorus under similar reaction conditions. W77-09152

COMPARISON OF EUTROPHICATION MODELS, Environmental Protection Agency, Atlanta, Ga. Technical Support Branch. J. S. Tapp.

In: Proceedings of the EPA Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 50-56, July 1976. 17 fig, 4 tab, 9 ref.

Descriptors: *Water quality control, *Eutrophication, *Simulation analysis, *Decision making, *Mathematical models, Aquatic environment, Lakes, Reservoirs, Data collections, Management, Georgia, Alabama, Dissolved oxygen, Systems analysis. Identifiers: Comparison, Lake Harding.

A complex mathematical model for simulating an aquatic ecosystem has been compared with less complex models of the type developed by Vollen-

weider to determine whether or not utilizing the sophisticated mathematical approach adds to the decision making ability in contrast to the less complex models. The complex reservoir model (EPAECO) and the Vollenweider approach are compared using Lake Harding on the Chattahoochee River in Georgia and Alabama. Data collected by the EPA National Eutrophication Survey on 66 Southeastern water bodies have been used to test the Vollenweider-type models. Results indicate that for Lake Harding either approach would give comparable results in terms of the decision to limit point source phosphorus to the reservoir. (See also W77-09154) (Bell-Cornell) W77-09159

MODELING THE EFFECT OF PESTICIDE LOADING ON RIVERINE ECOSYSTEMS, Southeast Environmental Research Lab., Athens, Ga.

For primary bibliographic entry see Field 5B. W77-09174

MODELING THE HYDRODYNAMIC EFFECTS OF LARGE MAN-MADE MODIFICATION TO LAKES, Case Western Reserve Univ., Cleveland, Ohio. Dept. of Earth Sciences.

For primary bibliographic entry see Field 5B. W77-09177

AN EMPIRICAL MODEL FOR NUTRIENT RATES IN LAKE ONTARIO, Environmental Protection Agency, Rochester, New York. Rochester Field Office.

P. A. A. Clark, J. P. Sandwick, D. J. Casey, and A. Solpietro.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 176-181, July 1976. 6 fig, 9 tab, 13 ref.

Descriptors: *Water quality control, *Lake Ontario, *Nutrients, *Mathematical models, *Simulation analysis, Nitrites, Nitrates, Ammonia, Seasonal, Sulfates, Data collections, Computer programs, Computer models, Equations, Systems analysis.

Identifiers: *Accumulation rates, Total organic carbon.

Based on the chemical concentration data collected during the International Field Year for the Great Lakes—May 1972 through June 1973, monthly average rates of chemical accumulation have been determined for total phosphate, nitrite-nitrate, ammonia, total Kjeldahl nitrogen, total organic carbon, and SO₄. The accumulation rates are the consequence of such processes as biochemical transformation processes, sediment exchanges, etc. The model presented relates the accumulation rate of a particular substance with the rate of exchange of the total mass of that substance in the lake and with the total net loading rate to the lake. The total masses of each chemical substance for each of the 11 cruises have been calculated using the computer program SPLITCH with the input of concentration measurements which were collected from about 75 stations on the lake from depths of 1 to 150 meters and at the lake bottom. This study is described together with the U.S. tributary loading rates and the direct onlake precipitation loading rates. Included Canadian tributary loading rates for the same period. The mass balance equation relating these quantities and the accumulation rate is derived herein. All quantities in the equation can be evaluated directly on the basis of measured lake concentrations and loading rates so that the equation can be solved for the accumulation rate in each case. Analysis of the equation will provide a means for the assessment of certain assumptions which are commonly made in large lake limnology. (See also W77-09154) (Bell-Cornell) W77-09178

A COMPUTER MODELING STUDY TO ASSESS THE EFFECTS OF A PROPOSED MARINA ON A COASTAL LAGOON

Connell/Metcalf and Eddy, Coral Gables, Fla. K-M. Lo, T. G. King, and A. S. Cooper.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 414-418, July 1976. 2 fig, 1 tab, 10 ref.

Descriptors: *Computer models, *Simulation analysis, *Effects, *Marinas, *Coasts, *Lagoons, *Water quality, Hydrography, Florida, Pollutants, Estimating boats, Equations, Systems analysis, Forecasting.
Identifiers: Flushing characteristics, Field surveys.

A water quality and hydrographic study was conducted to determine the effects of a proposed marina on the water quality of Old Pass Lagoon, located on the northwest coast of Florida. Utilizing field data, the flushing characteristics of the lagoon were determined using two methods. An estimate of pollutants discharged from engines of boats using the marina was made based on information in the literature. Based on the flushing characteristics and the estimate of pollutants, the postconstruction water quality was predicted using a steady state water quality model. (See also W77-09154) (Bell-Cornell)
W77-09194

A RIVER BASIN PLANNING METHODOLOGY FOR STREAMS WITH DISSOLVED OXYGEN AND EUTROPHICATION CONSTRAINTS

Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
For primary bibliographic entry see Field 5B.
W77-09198

ENVIRONMENTAL CONTAMINANTS INVENTORY STUDY NO. 3, THE PRODUCTION, USE AND DISTRIBUTION OF LEAD IN CANADA

Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch.
For primary bibliographic entry see Field 5B.
W77-09221

AN ASSESSMENT OF KRAFT BLEACHERY EFFLUENT TOXICITY REDUCTION USING ACTIVATED SLUDGE

Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
For primary bibliographic entry see Field 5D.
W77-09223

METHANE PRODUCTION AND CONSUMPTION IN ANOXIC MARINE SEDIMENTS

Scripps Institution of Oceanography, La Jolla, Calif.
R. O. Barnes, and E. D. Goldberg.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 520. Price codes: A02 in paper copy, A01 in microfiche. Reprinted from: *Geology*, Vol 4 p 297-399, May 1976. 1 fig, 27 ref. N00014-75-C-0152.

Descriptors: *Methane, *Water pollution, *Sediments, Diagenesis, *California, Sulfates, *Bacteria, Sulfur bacteria, Methane bacteria.
Identifiers: *Sulfate reduction, *Anoxic sediments (Marine), Desulfovibrio, Sulfur reducing bacteria, Methanogenic bacteria, *Santa Barbara basin (Calif.).

The production of methane in anoxic environments can lead to significant accumulations of this gas in appropriate marine sediments. However, the uniformly low methane concentrations in marine, anoxic, sulfate-reducing sea water and sediments represents a balance between produc-

tion by methanogenic bacteria and consumption by sulfate-reducing bacteria. The primary sink for anaerobically generated methane in marine sediments is sulfate reduction, not aerobic oxidation. (Sinha-OEIS)
W77-09230

VULNERABILITY MODEL: A SIMULATION SYSTEM FOR ASSESSING DAMAGE RESULTING FROM MARINE SPILLS

Enviro Control, Inc., Rockville, Md.
N. A. Eisenberg, C. J. Lynch, and R. J. Breeding.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A015 245. Price codes: A16 in paper copy, A01 in microfiche. U.S. Coast Guard Office of Research and Development, Washington, D.C., Report No. CG-D-136-75, June 1975. 370 p.

Descriptors: *Oil spills, *Damages, *Water pollution effects, Computer models, *Simulation analysis, Model studies, Comprehensive planning, Decision making.
Identifiers: *Hazardous materials, *Vulnerability models.

The Vulnerability Model (VM) is a computerized simulation system for assessing damage that results from marine spills of hazardous materials; the final report, summarized here, describes the research background, computation techniques, and preliminary test results associated with the first stage of development of the VM. This first stage of model development consisted of the design and implementation of an operational computer simulation, thereby demonstrating the feasibility of the philosophy, concepts, and approaches pertaining to the VM. Certain aspects of the modeling, as now operational, are subject to enhancement by augmentation, increase in precision, or both. Ultimately, the model is intended to be a comprehensive tool for assessing damage resulting from marine spills. (Sinha-OEIS)
W77-09239

PRELIMINARY INVESTIGATION OF BENTHIC RESOURCES AT DEEPWATER DUMPSITE 106

National Marine Fisheries Service, Highlands, N.J. Middle Atlantic Coastal Fisheries Center.
J. B. Pearce, J. Thomas, and R. Greig.
In: NOAA Dumpsite Evaluation Report 75-1, p 217-228, December 1975. 1 fig, 4 tab, 13 ref.

Descriptors: *Baseline studies, Water resources, *Benthos, *Heavy metals, Metals, Aquatic life, Sediment, Surveys.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites.

A baseline benthic survey was conducted at Site 106 and at several stations in the surrounding area. The principal objectives of the survey included: (1) the determination of the distribution, abundance, and diversity of the benthic infauna in particular to relate findings to those previously obtained by other investigators working in the Middle Atlantic Bight at similar water depths; (2) the establishment of the variation in the infauna in samples collected at Site 106 and surrounding area or in similar water depths; (3) the determination of the relationship between the benthic infauna and physical sediment types found at stations in different water depths; (4) the measurement of the quantities of heavy metals in sediments at Site 106 and other stations in similar depths; and (5) the measurement of the body burdens of heavy metals in organisms collected in the general vicinity of Site 106 and at other stations in similar water depths. (See also W77-09243) (Sinha-OEIS)
W77-09252

ARCHIBENTHIC AND ABYSSOBENTHIC FISHES OF DEEPWATER DUMPSITE 106 AND THE ADJACENT AREA

Virginia Inst. of Marine Science, Gloucester Point. J. A. Musick, C. A. Wenner, and G. R. Sedberry.

In: NOAA Dumpsite Evaluation Report 75-1, p 229-269, December 1975. 2 fig, 8 tab, 75 ref, append. Also as V.I.M.S. Contribution No. 722. Sea Grant 04-4-158-31.

Descriptors: *Baseline studies, *Benthos, *Waste disposal, *Radioactive waste disposal, Water resources, Ecology.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites.

Deepwater Dumpsite 106 is located 145 km off the coast of New Jersey and is bounded by the latitudes of 38 degrees 40 minutes and 39 degrees 00 minutes N and longitudes 72 degrees 00 minutes and 72 degrees 30 minutes W. The depth varies from about 1300 m in the northwest corner to 2700 m in the southeast. Most depth varies from about 1300 m in the northwest corner to 2700 m in the southeast. Most of the site is deeper than 2000 m. Within DWD 106 is a smaller dumpsite that has been in use for many years for industrial wastes and munitions. Due south of DWD 106 is an additional dumpsite at which the Atomic Energy Commission reported dumping radioactive wastes (rad site). The purpose of this report is to describe the fish fauna in the area of DWD 106 and to provide information on the ecology of dominant species. It is recommended that consideration be given to move the locality of the dumpsite south to about the vicinity of the rad dumpsite. Such a move would place the site entirely on the continental rise away from the influence of Tom's Canyon and the diverse slope ichthyofauna. Diversity and biomass of fishes are lower on the rise and the bottom is well below the mesopelagic zone. In addition, the chance of encountering pelagic eggs and larvae of commercially important species spawned on the continental shelf will be reduced. (See also W77-09243) (Sinha-OEIS)
W77-09253

AN ANALYSIS OF PLANKTON FROM DEEPWATER DUMPSITE 106

New York Ocean Science Lab., Montauk. Dept. of Fisheries Oceanography.
H. M. Austin.
In: NOAA Dumpsite Evaluation Report 75-1, p 271-357, December 1975. 42 fig, 12 tab, 22 ref, append. Also NYSOL Contribution No. 58.

Descriptors: *Plankton, *Baseline studies, *Waste disposal, Water resources, New York.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites.

Deepwater Dumpsite 106 is an area beyond the continental shelf off New York. During May 1-23, 1974, the National Marine Fisheries Service vessel Albatross IV conducted a survey of DWD 106 and adjacent areas to characterize the region and provide the necessary data to determine the advisability of continued dumping. This report of the field investigation describes the biological populations of the area and several biological/watermass relationships. It includes: (1) description of displacement volume and dry weight for each sample; (2) fish eggs, fish larvae, and invertebrate plankton abundance (identified to species level for more abundant forms); and (3) a discussion of their distribution and abundance relative to significant oceanographic features. (See also W77-09243) (Sinha-OEIS)
W77-09254

SYSTEMATIC ANALYSIS OF MIDWATER FISHES OBTAINED AT DEEPWATER DUMPSITE 106 MAY 1974

Rhode Island Univ., Kingston. Dept. of Zoology. W. H. Krueger, M. J. Keene, and A. A. Keller.

Descriptors: *Baseline studies, *Aquatic life, *Resources development, Water resources, Fishes.
Identifiers: *Outer Continental Shelf, Ocean dumping, Dumpsites, Dumpsite biota, Systematic analysis.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Ten oblique tows of a 10-foot Isaacs-Kidd mid-water trawl at Deepwater Dumpsite 106 produced 4,029 specimens having a total volume of 2,523 ml. These represent 114 species in 30 families. Analyses of the catch data suggest that these fishes have clumped distributions, and that they are stratified in the water column according to size. Thirty-three species are considered particularly important: four eel leptocephali, and 29 mesopelagic species (mostly gonostomatids and myctophids) that appear to spawn in the study area. These 33 species account for 92% of all the specimens taken and 70% of the total biomass. Because of the diversity of distributional patterns in midwater fishes, future monitoring of the study area should include discrete-depth sampling throughout the water column at all seasons of the year, and comparisons with a different area of the slope water. (See also W77-09243) (Sinha-OEIS) W77-09255

MICROBIOLOGICAL STUDY OF FAUNAL RESPONSE TO SPRAY IRRIGATION OF CHLORINATED SEWAGE EFFLUENT, Pennsylvania State Univ., University Park. Dept. of Veterinary Science. R. Kozlowski.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 515. Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, August 1974. 94 p, 14 tab, 1 fig, 42 ref, append. OWRT B-059-PA(3), 14-31-0001-3932.

Descriptors: *Irrigation, *Song birds, *Animal populations, *Sewage effluent, *Waste water disposal, Coliforms, E. coli, Wildlife, Deer. Identifiers: *Effluent spraying, *Chlorinated sewage effluent, *Microbiological effect, *White-tailed deer, *Cottontail rabbit, Serotype, Salmonella, Klebsiella sp, Sludge-injected effluent, Fecal streptococci, Fecal coliform, Total coliform.

The microbiological effect was investigated of chlorinated sewage effluent on the environment and related animal populations from June 1972 through August 1973. The chlorinated effluent was sprayed on sections of Pennsylvania State Game-lands 176. Samples of the effluent and ponds in the area, and fecal samples of white-tailed deer, cottontail rabbits, and songbirds were obtained and analyzed. The total coliform, and fecal streptococci counts of the effluent and sludge-injected effluent clearly illustrated that these bacterial agents are being introduced into the environment. These results further demonstrated that the sludge-injected effluent spray contributed higher levels of contamination to the environment than the spraying of effluent alone. Future work is needed to determine the serological identity of the resident coliforms of wildlife and also of those serotypes that could possibly be pathogenic for wildlife. (Sink-Penn State) W77-09270

RESPONSE OF THE SPOKANE RIVER DIATOM COMMUNITY TO PRIMARY SEWAGE EFFLUENT, Eastern Washington State Coll., Cheney. Dept. of Biology. P. H. Williams.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 532. Price codes: A03 in paper copy, A01 in microfiche. MS Thesis, Spring 1975. 38 p, 9 fig, 8 tab, 33 ref. OWRT A-058-WASH(4), 143-34-10E-3996-5501.

Descriptors: *Diatoms, *Sewage effluents, *Washington, Outfall sewers, Sampling, Biomass, Phosphates, Nitrogen, Bioassay, Water pollution. Identifiers: *Spokane River(Wash), *Achnanthes sp, Algal growth.

This study examined the effects of the primary sewage effluent from the City of Spokane,

Washington on the diatom community in the Spokane River. Both natural and artificial substrates were used at each of three sampling stations, one above and two below the sewage outfall, to determine the impact of the effluent on species composition, species diversity, and autotrophic index. Water chemistry samples were taken concurrently with diatom collections and composited for use in determining the algal growth potential of the water. A total of 51 species in 18 genera of diatoms were identified. The flora was dominated by *Achnanthes* spp. with this genus accounting for 63.6 percent of the cells observed. Nine of the ten most abundant diatom taxa showed statistically significant changes in abundance below the sewage discharge. In each of these ten species there was a significant correlation between their numbers and orthophosphate or ammonia nitrogen concentrations. Mean autotrophic index values of 203 above and 1005 below the sewage outfall indicate the effluent promoted an increase in heterotrophic biomass. Results from algal assays using *Selenastrum capricornutum* Printz as a test organism suggest that total algal growth above the discharge may have been limited by phosphorus concentration while below the effluent heavy metal inhibition seemed to predominate. In terms of individual species abundance, mean diversity indices, floristic similarities between sampling stations, and mean autotrophic indices, the diatom community at the last downstream station had begun to recover from the effects of organic pollution introduced via the sewage. W77-09273

LEAD EFFECTS ON SEVERAL ENZYMES AND NITROGENOUS COMPOUNDS IN SOYBEAN LEAF, Taiwan Provincial Chung-Hsing Univ., Taichung.

K. C. Lee, B. A. Cunningham, K. H. Chung, G. M. Paulsen, and G. H. Liang. Journal of Environmental Quality, Vol. 5, No. 4, p 357-359, October-December 1976. 3 tab, 24 ref.

Descriptors: *Enzymes, *Lead, *Heavy metals, *Soybeans, Ammonia, Proteins, Calcium, Phosphorus, Leaves, Respiration, *Nitrogen compounds, Water pollution effects.

To obtain further evidence on the nature of lead toxicity in plants, the Pb(2+) effect of several enzyme activities and nitrogenous compounds in soybean was investigated. Soybean seedlings were grown in culture solution treated with lead nitrate so that final concentrations of lead Pb(2+) were 0, 20, 60, and 100 mg/liter. Soybean leaves were analyzed 10 days after lead was added to the solution. Results showed increased respiration rate, increased activities of acid phosphatase, peroxidase and alpha-amylase, and increases in soluble protein and ammonia. There was no significant change in malic dehydrogenase, and total free amino acids. A decrease was observed for glutamine synthetase activity and nitrate. Leaf calcium and phosphorus decreased as the lead concentration was increased in the culture solution. Increased activities of the hydrolytic enzymes and peroxidase indicates that the lead treatment enhances senescence. (Skogerboe-Colorado State) W77-09280

EFFECT OF DISSOLVED OXYGEN ON REDOX POTENTIAL AND NITRATE REMOVAL IN FLOODED SWAMP, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.

R. M. Engler, D. A. Antie, and W. H. Patrick, Jr. Journal of Environmental Quality, Vol. 5, No. 3, p 230-235, July-September 1976. 6 fig, 2 tab, 14 ref.

Descriptors: *Nitrates, *Dissolved oxygen, *Louisiana, *Floodwater, Coastal marshes, Laboratory tests, Soil investigations, Swamps, *Oxidation-reduction potential. Identifiers: Reduction capacity.

The O₂ depletion rates, NO₃(-) loss, and the effects of added O₂ on NO₃(-) disappearance and redox potential in four flooded or intermittently flooded soils from the swamp and coastal marshes of Louisiana were quantitatively characterized in a laboratory study. The NO₃(-) added either to the shallow floodwater or mixed with the soil in a suspension rapidly disappeared. Eighty to ninety parts per million NO₃(-) was lost from the soil suspensions in 1 to 4 days and from the floodwater over a soil in 10 to 20 days. No NO₃(-) was lost from floodwater separated from the soils. Oxygen depletion in the soil suspensions occurred in 15 minutes to 4 hours. Redox potential curves exhibited a characteristic inflection after O₂ disappearance in all soils studied. Nitrate disappearance did not appear to be inhibited by as much as 16 ppm O₂ dissolved in the soil suspensions because the O₂ was rapidly consumed. (Skogerboe-Colorado State) W77-09286

STUDY OF MERCURY INTOXICATION IN A TELEOST FISH, ANGUILLA ANGUILLA: I. ACCUMULATION OF MERCURY IN THE ORGANS, (IN FRENCH), Liege Univ. (Belgium). Laboratoire de Biologie Generale.

J. M. Bouqueneau. Bull Soc R Sci Liege. 42(9/10), p 440-446, 1973.

Descriptors: *Mercury, *Teleosts, *Toxicity, Poisons, Fish, Inorganic compounds, Bioassay, Assay, Eels, Water pollution effects, Pollutant identification. Identifiers: *Anguilla anguilla*, Brain, Organs, Gill, Kidney, Liver, Muscle, Spleen.

A profile of Hg accumulation is established during direct poisoning with HgCl₂. The gills are the only organ studied that accumulates Hg in any important fashion, when intoxication is of brief duration. During chronic intoxication, the gills, kidney, spleen, liver and brain are the organs most highly contaminated. An interpretation of Hg accumulation profiles is proposed, and the possibility of a biological test is indicated, based on the assay of Hg in the muscles and liver of the eel. (See also W77-09321) --Copyright 1975, Biological Abstracts, Inc. W77-09320

STUDY OF MERCURY INTOXICATION IN A TELEOST FISH, ANGUILLA ANGUILLA: II. EFFECT ON THE REGULATION OF OSMOLARITY, (IN FRENCH), Liege Univ. (Belgium). Laboratoire de Biologie Generale.

J. M. Bouqueneau. Bull Soc R Sci Liege. 42(9/10) p 447-455, 1973.

Descriptors: *Mercury, *Teleosts, *Toxicity, Poisons, Fish, Inorganic compounds, Eels, Adaptation, Ion transport, Water pollution effects. Identifiers: *Anguilla anguilla*, Gill, Osmolarity, Ionic regulation.

When the HgCl₂ concentration in water exceeds 1 ppm, Hg has a lethal effect on the ionic regulation of the eel. At lower concentrations, Hg has a sublethal effect, followed by adaptation. The effect of Hg on ion transport in the gills and the ecologic followed by adaptation. The effect of Hg on ion transport in the gills and the ecologic consequences of adaptation are discussed. (See also W77-09320) --Copyright 1975, Biological Abstracts, Inc. W77-09321

ACID MINE DRAINAGE (AMD) AND ITS IMPACT ON A SMALL VIRGINIA STREAM, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.

R. C. Hoehn, and D. R. Sizemore. Water Resources Bulletin, Vol. 13, No. 1, p 153-160, February 1977. 2 fig, 15 ref.

Descriptors: *Mine drainage, *Acid mine water, *Toxicity, *Bioassay, *Virginia, Streams, Waste water(Pollution), Benthic fauna, Snails, Sunfishes, Biodegradation, Invertebrates, Alkalinity, Hydrogen ion concentration, Iron, Alkalies(Bases), Water pollution effects.
Identifiers: Biological effects, Chemical effects, Benthic population, *Chestnut Creek(Va).

A study was conducted to (1) chemically characterize three AMD streams entering Chestnut Creek in southwestern Virginia below the town of Galax, Virginia, and (2) to assess the biological and chemical alterations in the creek. Over a six mile reach, the benthic macroinvertebrate population was reduced to zero, the naturally low alkalinity (approximately 25 mg/l) of the stream was reduced to less than 5 mg/l, and the pH was reduced from 7.2 to 6.3. Increased concentration of iron from less than 0.01 mg/l to more than 4.0 mg/l was accompanied by the deposition of a coating of iron hydroxide up to 0.25 in thick in the stream bed, a phenomenon most likely responsible for the absence of benthic macroinvertebrates. In situ bioassays with bluegill sunfish and one snail species showed that the creek water, after confluence with all the AMD streams, was not toxic in 192 hours to fish, and snails survived 96 hours before they began to die. The undiluted AMD itself was highly toxic. (Visocky-ISWS)
W77-09332

A BIOLOGICAL AND CHEMICAL COMPARISON OF VARIOUS AREAS OF A RESERVOIR.
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
A. C. Hendricks, and J. K. G. Silvey.
Water Research, Vol. 11, No. 5, p 429-438, May 1977. 3 fig, 8 tab, 18 ref.

Descriptors: *Chemical properties, *Biological properties, *Limnology, *Reservoirs, *Eutrophication, *Texas, Analytical techniques, Water properties, Analysis, Nutrients, Water chemistry, Chlorophyll, Productivity, Nitrates, Water quality, Phosphates, Sediments, Water analysis.
Identifiers: *Biological comparison, *Limnological survey, *Biological productivity, *Garza-Little Elm reservoir(Tex), Oxygen utilization, Primary producers, Microbial activity, Nutrient levels.

A limnological survey was made of a Texas reservoir. Biological (heterotrophic and autotrophic uptake of carbon, chlorophyll a, and oxygen utilization) studies and chemical (nitrate-N and phosphate-P) studies were made on various areas of the reservoir. The area were physically different, i.e., coves, open water, and nearshore water, and the testing program was designed to determine if differences did exist among the areas. The data indicated that a cove that had a marina located on it was not significantly different from one that did not have a marina but was very similar in other aspects. An open water area in which many trees had been left standing was shown to be more eutrophic than other areas near it. Another open water area with sediments rich in nutrients was shown to be less eutrophic than shallower areas near it. (Henley-ISWS)
W77-09342

USE OF LARGE SUBMERGED CHAMBERS TO MEASURE SEDIMENT-WATER INTERACTIONS.
Great Lakes Basin Commission, Ann Arbor, Mich.
For primary bibliographic entry see Field 5B.
W77-09343

OXYGEN CONSUMPTION BY FRESHWATER SEDIMENTS.
Clemson Univ., S.C. Dept. of Environmental Systems Engineering; and Clemson Univ., S.C. Dept. of Microbiology.
W. S. Brewer, A. R. Abernathy, and M. J. B. Paynter.
Water Research, Vol. 11, No. 5, p 471-473, May 1977. 3 fig, 1 tab, 8 ref.

Descriptors: *Oxygen demand, *Oxygen requirements, *Sediments, *Biological communities, Biochemical oxygen demand, Laboratory tests, Sampling, Bacteria, Oxygen, Biological properties, Dissolved oxygen, Lakes, Lake sediments, Sedimentation, Limnology.
Identifiers: *Oxygen consumption.

The purpose of this study was to measure the oxygen consumption rate of sediments and to determine the amount of oxygen consumption attributable to biological activity. Closed systems were utilized to measure oxygen uptake, and phenol or potassium cyanide were introduced to eliminate biological respiration. (Sims-ISWS)
W77-09348

ENVIRONMENTAL CHANGES IN LAKE ERIE AND THEIR FUTURE IMPACT ON LAKE RESOURCES.
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
R. A. Cole.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-240 680. Price codes: A06 in paper copy, A01 in microfiche. Report No. MSU-IWR-TR-73-0032.3, 1973. (Technical Report 0.32.3) 106 p. 12 fig., 6 tab., 77 ref.

Descriptors: *Future planning(Projected), *Lake Erie, *Planning, *Management, *Competing uses, Water utilization, Recreation, Projections, Industries, Aesthetics, Fisheries, Eutrophication, Phosphorus, Dissolved solids, Nutrient removal, Waste treatment, Domestic wastes, Industrial wastes, Institutional constraints, Cost-benefit analysis.

Human-induced changes in Lake Erie and how they affect its current and future uses are discussed. Guidelines are suggested for comprehensive, interdisciplinary planning of the Erie basin based on assessment of the lake's resources and probable future demands. A generalized analysis of social costs and benefits indicates that a total ban on waste effluents into the lake would not be justified until the discharges begin to interfere with the total resource value of the lake. However, a modified form of pollution control would be appropriate even though it would not be compatible with present cost-benefit concepts. Conflicts over commercial and recreational uses, planning strategies, and bureaucratic inadequacies are discussed. Conflicts over uses and future demands, particularly as affected by energy shortages, are translated into resource values to point out the need for rigorous resource evaluation before costly management schemes are instituted. Appropriate resource management directions, other than the traditional justifications, are proposed. The impact of eutrophication on domestic water, the effect of phosphorus removal from domestic wastes, the impact of shipping, erosion from agriculture and construction, commercial and sport fishing industries, cooling and industrial water demand, industrial wastes, and the various recreation demands are evaluated in a simple cost-benefit analysis. (Auen-Wisconsin).
W77-09454

TECHNICAL AND MICROECONOMIC ANALYSIS: ARSENIC AND ITS COMPOUNDS.
Versar, Inc., Springfield, Va.
For primary bibliographic entry see Field 5B.
W77-09465

ECOLOGICAL STUDIES ON ALGAL-LYSING BACTERIA IN FRESH WATERS.
Dundee Univ. (Scotland). Dept. of Biological Sciences.
M. J. Daft, S. B. McCord, and W. D. P. Stewart.
Freshwater Biology, Vol 5, No 6, p. 577-596, 1975. 10 fig., 8 tab., 18 ref.

Descriptors: *Bacteria, *Distribution, *Aquatic algae, Freshwater, Ecosystems, Myxobacteria, Lakes, Reservoirs, Cyanophyta, Ecological distribution.
Identifiers: *United Kingdom, *Algal-lysing bacteria.

Data on the distribution of algal-lysing bacteria in various freshwaters of the United Kingdom and on some of the factors likely to influence their ecological distribution are presented. Algal-lysing bacteria examined were found in 8 freshwater habitats, including 6 lochs and 2 reservoirs, as well as a sewage works. None out of 36 isolates, all gram-negative non-fruited myxobacteria, were studied in detail. All were aerophilic, required a neutral or alkaline pH for good growth, had a temperature optima of 28-37°C, required contact with the host for lysis to occur, and were similar enough in morphology and host range to appear to be strains of a single genus. They lyse species of bloom-forming Cyanophyceae including *Anabaena*, *Aphanizomenon*, *Gloeotrichia*, *Microcystis* and *Oscillatoria*. Their abundance correlated directly with the abundance of Cyanophyceae in eutrophic waters. It is suggested that the algae and bacteria co-exist in most ecosystems, but that if the equilibrium changes markedly as a result of environmental changes, the bacteria may play an important role in the lysis of algal blooms. (Luedtke-Wisconsin).
W77-09469

INTERDEPENDENCE BETWEEN SEVERAL DIFFERENT SPECIES OF ALGAE INVESTIGATED IN CULTURES.
M. Bombowna, H. Bucka, J. Zygmuntowa, and G. Jaworski.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 2741-2748, 1975. 6 fig., 11 ref.

Descriptors: *Algae, *Eutrophication, *Succession, Biological communities, Dominant organism, Foreign research, Nutrients, Diatoms, Chlorophyta, Cyanophyta, Growth rates, Productivity, Reservoirs.
Identifiers: *Poland.

As part of a study of eutrophication caused by construction of artificial reservoirs on rivers in the Carpathian mountains of southern Poland, regression and association of certain algal species in community structures by the introduction of nitrogen, phosphorus and silica was investigated at the Polish Laboratory of Water Biology, using cyanophytes, bacillariophytes, and chlorophytes in mixed and unialgal cultures. Experimental details are given of measurements of algal demand of nitrogen, phosphorus, and silica compounds, the biomass and growth rates under controlled temperature and light, and primary production and extracellular release of organic matter and free amino acids. There is usually a positive correlation between the relative algal growth rate, intensification of photosynthesis and the amount of organic matter released; in periods of intense growth a very small amount of amino acids are released extracellularly but with growth inhibition amino acid releases significantly increases. In mixed communities, the small body-size species dominate the photosynthesis and release of organic matter, thus their high productivity increases the trophic character of water. Phosphorus compounds are readily released from algal cells and are a source of orthophosphate in water bodies. The blue-green *Aphanizomenon flos-aquae* reduces community diversity, while diatoms and chlorophytes enhance diversity. (Auen-Wisconsin).
W77-09470

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

EVALUATION OF PETROLEUM-DEGRADING POTENTIAL OF BACTERIA FROM WATER AND SEDIMENT,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W77-09472

ENVIRONMENTAL IMPACTS OF HIGH LEVEL RADIOACTIVE WASTE DISPOSAL,
Pittsburgh Univ., Pa.
B. L. Cohen.
Institute of Electrical and Electronic Engineers, Nuclear Science, Vol 23, No 1, p 56-59, 1976. 4 fig, 1 tab.

Descriptors: *Radioactive waste disposal, *Hazards, *Safety, *Breeding reactors, *Radioactivity effects, Mathematical models, Underground waste disposal, Nuclear wastes, Probability, Water pollution, Groundwater.

Possible potential hazards from underground disposal of high level nuclear wastes from fuel reprocessing plants are discussed and mathematically evaluated. The calculations are based on nearly twice the present annual United States nuclear power production and the various isotopes are plotted vs. time after reprocessing showing inhalation and ingestion effects as related to cancer doses and mortalities of the worst possible credible handling. A mathematical model presents an upper limit estimate of the probability for buried water to escape and be ingested by people using the comparison of radium in the rock above the buried waste and assuming that the probability for an atom of waste to be released from underground is no greater than for an atom of radium above it. The calculations show that after a few hundred years deaths would be below 0.000,001 per year from all nuclear power. On the assumption that no releases occur for the first two hundred years, it is essential that 0.4 eventual fatalities would be incurred for each year of all-nuclear power, as the upper limit. If a cancer cure is found after 100,000 years, the effect would be reduced by an order of magnitude. The burning of near-surface U-238 deposits is viewed as cleansing the earth of radioactivity. Several possibilities of underground waste releases are considered as are their effects on future generations. (Auen-Wisconsin)
W77-09473

PSEUDOMONAS AERUGINOSA-FECAL COLIFORM RELATIONSHIPS IN ESTUARINE AND FRESH RECREATIONAL WATERS,
National Marine Water Quality Lab., West Kingston, R.I.
For primary bibliographic entry see Field 5A.
W77-09474

ON THE OCCURRENCE OF THE SPECIES OF SYNURA (CHRYSOPHYCEAE),
J. Kristiansen.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 2709-2715, 1975. 6 fig., 11 ref.

Descriptors: *Chrysophyta, *Diatoms, *Plant morphology, *Systematics, *Plant ecology, Speciation, Electron microscopy, Temporal distribution, Plant ecology, Plant morphology, Lakes.
Identifiers: *Synura, *Denmark.

The ecological distribution of the chrysophyte diatoms of the *Synura* species and their typology were investigated in 138 Danish lakes and ponds. Their characteristic form is easily recognizable by means of light microscopy in dried preparations, and even living cells can be identified by phase contrast microscopy of their silica scales. However, species determination is most reliable when supported by electron microscopy. Use of the latter method has identified twelve species: *S. curtipinna* (Petersen and Hansen) Asmund, *S. echinulata* Korshikov, *S. favus* Bradley, *S. glabra*

Korshikov, *S. lapponica* Skuja, *S. macracantha* (Petersen and Hansen) Asmund, *S. manillosa* Takahashi, *S. petersenii* Korshikov, *S. sphagnicola* Korshikov, *S. spinosa* Korshikov, *S. splendida* Korshikov, and *S. wella* Stein em. Korshikov. Seven of these species were found in Denmark. No geographical differences in distribution was found and their occurrence is believed to be related to cold water, mostly in early spring, but some species prefer warm and high temperatures. Their distribution in relation to pH varies with species. (Auen-Wisconsin).
W77-09476

THE WINTER DARK SURVIVAL OF AN ALGAL FLAGELLATE-CRYPTOMONAS EROSA (SKUJA),
K. Morgan, and J. Kalf.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 2734-2740, 1975. 5 fig, 1 tab, 10 ref.

Descriptors: *Algae, *Viability, *Winter, *Ice cover, Physiological ecology, Nannoplankton, *Canada, Light intensity, Photosynthesis.
Identifiers: *Dark survival of algae, *Cryptomonas erosa.

How the Cryptophyceae and Chrysophyceae algae survive under snow and ice cover and during polar nights is described. Using an isolate of *Cryptomonas erosa* exposed to a variety of light-temperature regimes, it was noted that its Mean cell volume at 15°C correlated positively with light intensity, so that cells grown at 450 ft c were over 2.5 times larger than those grown at 10 ft c. At limiting light levels, the algae does not receive enough energy to saturate all growth phases, and this limited supply is first channeled into maintenance with any surplus going into growth and remainder into cell division. Only at high light regimes when energy exceeds these requirements, will storage products accumulate and induce cell enlargement. Growth at 4°C reduces the light level at which the cell is saturated and inhibited, and lowers the estimated compensation intensity to approximately 1 ft c. While low temperatures retard cell division, photosynthesis at suboptimal light levels is temperature independent and carbon fixation per unit cell volume at 4°C is equal to rates at 5°C. Since carbon fixation and cell division occur at different rates, the cell accumulates organic mass which is reflected in a 50-100% increase in cell volume. Thus long survival of *C. Erosa* in the dark is largely dependent on the slow respiration of stored carbohydrates, initiated during late autumn. (Auen-Wisconsin)
W77-09482

MICROSTRATIFICATION OF LAKE WASHINGTON SEDIMENTS,
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 770-775, 1975. 3 fig, 9 ref.

Descriptors: *Sedimentology, *Dating, *Stratigraphy, *Eutrophication, *Electron microscopy, *Lake sediments, Sedimentation, *Stratification, Cyanophyta, Diatoms, *Washington, Analytical techniques.
Identifiers: *Scanning electron microscopy(SEM), *Lake Washington(Wash).

In research aimed at studying the sedimentary record of eutrophication in Lake Washington (Wash.), scanning electron microscopy (SEM) was used to determine sediment distribution on as small a scale as possible. Examination of sediment cores at various levels of magnification shows that while the lake no longer produces dense populations of blue-green algae during summer, it produces some that contribute soft material to the sediment in the summer and it is still productive enough to support a prominent diatom population in the spring. During years of heavy eutrophication, each year after the spring diatom bloom, the summer and fall plankton was dominated by blue-

green algae, mostly *Oscillatoria*. Relatively few diatoms were present at all times except spring. The condition persisted through 1973. In the deeper sediment, the lack of prominent diatom layers presumably results from a smaller rate of deposition of diatoms and a closer balance between deposition of silt and diatoms. Presumably a condition closer to that of 1950 and 1933 is being re-established, in which a less-differentiated layering will again be produced. While recent sediments are not visibly varved, varved sections do occur several meters deep in the sediment. Examination with SEM confirms the existence of diatom layers at 3.60 m depth, principally *Stephanodiscus*, but the intermediate layers consist mostly of minute fragments of diatom frustules. (Harris-Wisconsin)
W77-09483

DISTRIBUTION AND SEASONAL VARIATION OF BENTHIC FAUNA IN LAKE MANITOBA,
C. Tudorancea, and R. H. Green.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 616-623, 1975. 2 fig, 4 tab, 6 ref.

Descriptors: *Benthic fauna, *Distribution, *Seasonal, Eutrophication, Lakes, On-site data collections, Basic data collections, *Canada, Biomass, Density, Animal populations, Diptera, Gastropods, Oligochaetes, Dominant organisms, Varieties.
Identifiers: *Lake Manitoba(Canada), Ostracods, Spheriidae.

A sampling program conducted on a seasonal basis in 1973-74 at seven stations in southern Lake Manitoba (Canada) showed that the numerically-dominant groups of benthic fauna in the shallow, eutrophic waters are Nematoda, Ostracoda, Chironomidae, Gastropoda, Spheriidae and Oligochaeta. Other groups present in relatively low densities were Trichoptera, Hydracarina, and Ceratopoda. Apart from Nematoda and Oligochaeta, which are not identified, 28 genera belonging to 19 families were found in the benthic fauna of the lake. Most of dominant groups were unevenly distributed on the bottom. Ostracods and chironomids seemed homogeneously distributed, but nematodes and gastropods had higher densities in the central-southern part of the lake and spheriids occurred in higher densities at the eastern stations. Of the major groups, oligochaets had the lowest densities and were found most often in the eastern part of the lake. Of 35 taxa identified, only six occur with mean frequency higher than 50%, and another four species occur with frequencies between 25% and 50%. With respect to seasonal variation in density of the abundant species, two species of chironomids were maximal in August and October. Both ostracod species had maxima in June. Molluscs were well represented in all seasons. (Harris-Wisconsin)
W77-09484

CARBON DIOXIDE EXCHANGE AND PRODUCTIVITY IN LAKE ERIE AND LAKE ONTARIO,
R. R. Weiler.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 694-704, 1975. 7 fig, 2 tab, 26 ref.

Descriptors: *Lake Ontario, *Lake Erie, *Carbon dioxide, *Primary productivity, *Carbon cycle, Absorption, Diffusion.
Identifiers: Carbonic acid, Lyman dissociation constants, Carbon release, Dissolved inorganic carbon.

In a follow-up to earlier research on calculated carbon dioxide fluxes for Lake Ontario based on measured carbon dioxide partial pressures in the air (Pco2) over the lake and calculated partial pressure (pCO2) in the lake, three topics are covered in the present study: (1) applicability of the Lyman values for the dissociation constants for carbonic

acid was tested by comparing calculated and measured value of alkalinity, total dissolved inorganic carbon, pCO₂ and acidity/alkalinity; (2) the flux from Lake Erie has been calculated and compared with the Lake Ontario results; and (3) direct measurements of pCO₂ and pCO₂ at a site on the Bay of Quinte near Belleville, Ontario have been used to obtain biological uptake or release of carbon dioxide according to a method described in 1966 research and compared with values obtained by other means. Comparisons between measured and calculated components of the dissolved inorganic carbon system showed that the Lyman apparent dissociation constraints are in fact applicable to Lake Ontario. Calculations show that Lake Erie acts as a net source of carbon dioxide over a year. Only in summer does it take up carbon dioxide. Net outflux from the lake is around 460 gC/sq m/year, within a factor of two of the lake's productivity. Measurements of pCO₂ and pCO₂ were used to find net change in two 'limnocoarals' in the Bay of Quinte and the flux between these and the atmosphere. Community metabolism and the gross productivity were calculated from these measurements. Gross productivity measurements were in reasonable agreement with values obtained using the oxygen light and dark bottle technique. (Harris-Wisconsin)

W77-09485

THE AQUATIC THERMAL CAPSULE,

Southern Illinois Univ. at Carbondale. Dept. of Botany.

J. D. Parsons.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 137-143, 1975, 3 fig, 17 ref.

Descriptors: *Heat budget, *Energy budget, *Swamps, Heat flow, Heat transfer, Seasonal, *Illinois, Thermal properties, Mud-water interfaces, Sediment-water interfaces, Shallow water, Ponds, Mixing, Solar radiation, Evaporation, Rainfall, Atmospheric pressure, Humidity, Oxbow lakes, Mississippi River.

Identifiers: Big Muddy River(III), LaRue Swamp(III), Otter Pond(III).

In efforts to construct an energy budget which would adequately define the aquatic thermal capsule of air, water and mud, thermal data was collected weekly during 1972 in a pond formed in part of an old channel of the former Big Muddy River in the mid-Mississippi River flood plain in southern Illinois. In Otter Pond, the open water area of LaRue Swamp, measurements were taken of solar and net solar radiation, rainfall, barometric pressure, relative humidity, and air, water and mud temperatures. Analysis of the data showed that: (1) the air phase of the thermal capsule during both summer and winter must be considered 'still air' as opposed to the circulation of spring and fall; (2) heat change by high-low temperature change or sensible heat and evaporation-condensation are in close agreement (3204 and 3281 cal sq cm for the heating period); (3) vertical mixing under the 'still air' mass fell below values for waters of the hypolimnion. However, the effects of periodic ice and vegetative mat cover on heat transfer have not yet been ascertained. Comparative data is also given for the Lake Hula swamp (Israel), and contrasts are made between the two study areas for diffusivity and overall heat budgets. (Harris-Wisconsin)

W77-09486

EFFECTS OF MAN-INDUCED AND NATURAL LOADING OF PHOSPHORUS AND NITROGEN ON THE LARGE SWEDISH LAKES,

T. Ahl.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 1125-1132, 1975, 5 fig, 2 tab, 17 ref.

Descriptors: *Eutrophication, *Phosphorus, *Nitrogen, Self-purification, Foreign countries, Algae, Nutrient removal, Chlorophyll, Pollution abatement.

Identifiers: *Lake Vanern(Sweden), *Lake Vattern(Sweden), Lake Malaren(Sweden), *Lake Hjalmar(Sweden), Water quality improvements.

The extent and effects of natural and anthropogenic loading of phosphorus and nitrogen on the Swedish Lakes Vanern, Vattern, Malaren and Hjalmar are discussed. Lake Vattern is characterized as oligotrophic, while Lake Vanern is becoming mesotrophic. The other lakes are considered eutrophic. Phosphorus loadings, due to human activity, have increased faster than nitrogen loadings. N:P ratios for man-induced loadings ranged from 2 to 18 with an average of 14. This caused a decrease in the N:P ratio from between 20 and 30 for the natural loading to between 15 and 20 for the man-induced load and increased the proportions favorable for algal growth and changes in species composition from cryptophycean and chrysophycean to chlorophycean and cyanophytes. The effect of reduction in P and N is predicted by equations giving the relationship between concentrations of summer chlorophyll-a and the annual loading rates of these nutrients. N and P loadings to the central part of Lake Malaren in 1972 were 40% of the 1967 values while chlorophyll concentration was 55% of the 1967 value. Decreased rates of sewage influents to Lake Malaren reduced both the N and P loads and were followed by a decrease in the summer chlorophyll concentrations even before improved sewage treatment was instituted. (Auen-Wisconsin)

W77-09487

ANALYSIS OF THE MACROFAUNA-COMMUNITY ON STRATIOTES VEGETATIONS,

L. W. G. Higler.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 2773-2777, 1975, 3 fig, 2 ref.

Descriptors: *Marsh plants, *Biological communities, *Rooted aquatic plants, Foreign countries, Algae, Zooplankton, Invertebrates, Submerged plants, Distribution patterns.

Identifiers: *Stratiotes, *Netherlands.

Inhabitants of Stratiotes aloides (water soldier) communities were investigated in Dutch shallow freshwaters, marshes, ponds, canals, and oxbow rivers. A thick saprobiotic layer is needed for optimal growth of this rooting waterplant, which is formed to a great extent by the dead plants themselves. This plant grows submerged in its younger stages or floats in the older stages. Its shape and dimensions provide a large surface for diatoms and filamentous algae and thus constitute lush meadows for grazers and their predators as well as providing shelter and attachment for benthic organisms. Preliminary investigations showed that about 150 species of macrofauna, excluding Chironomidae and Hydrachnellae, inhabit the Stratiotes vegetation. The most numerous were snails, followed by leeches, caddisfly larvae, mayfly larvae, flatworms, Asellus and the oligochaete Stylaria lacustris. Out of the twelve waterbug species collected only Cymatia coleopata was numerous. About fifteen species of dragonfly larvae were identified but they rarely occurred in large numbers. Adult dragonflies were always present and numerous and about 30 species were identified. A regular distribution pattern of a number of insect larvae was found to be related to the developmental stages of the Stratiotes. (Auen-Wisconsin)

W77-09489

NITROGEN FIXATION IN AQUATIC ENVIRONMENTS—A CRITICAL STUDY OF ACETYLENE REDUCTION ASSAY,

For primary bibliographic entry see Field 5A.

W77-09490

RESPONSE OF THE MACROINVERTEBRATE FAUNA TO A COPPER GRADIENT IN AN EXPERIMENTALLY-POLLUTED STREAM,

R. W. Winner, J. S. Van Dyke, N. Caris, and M. P. Farrel.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 2121-2127, 1975, 3 fig, 3 tab.

Descriptors: *Water pollution effects, *Copper, *Biological communities, *Invertebrates, Streams, Model studies, *Ohio, Analytical techniques, Measurement, Freshwater.

Identifiers: *Shayler Run(Ohio).

Freshwater invertebrate fauna, previously exposed to copper stress, was subjected to increased copper concentrations in Shayler Run (Ohio) and community response was measured. Four indices were used to evaluate community structure: (1) total number of species collected in two samples; (2) total number of individuals collected in two samples; (3) Margalef's index; and (4) Shannon's index. All Psephenus, Baetis, Limnoria and Stenonema intermedium completely disappeared where mean copper concentrations were 120 and 66 ppb, leaving the communities dominated by larval chironomids. Zygoptera were most abundant at mean Cu concentrations of 66 ppb, and a species of Stenelmis and one of Chamaelea attained maximum densities at Cu concentrations of 38 ppb; but this increase may have only reflected reduction in competition, predation, or both. Community composition where Cu concentration was 23 ppb was very similar to that of the control station (mean Cu concentration 9 ppb). It was found that simple, unmanipulated data, i.e., number of species and number of individuals, reflected the same pattern of community response to copper stress as did the more complex indices; furthermore, the simpler indices were more sensitive in detecting changes in community structure and exhibited a stronger correlation with the stressing agent. (Auen-Wisconsin)

W77-09491

CHLORINE-CONTAINING STABLE ORGANICS: NEW COMPOUNDS OF ENVIRONMENTAL CONCERN,

C. W. Gehrs, and R. L. Jolley.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 2185-2188, 1975, 3 fig, 5 ref.

Descriptors: *Chlorine, *Organic compounds, *Daphnia, *Water pollution effects, Zooplankton, Lethal limit, Reproduction, Mortality, Sewage treatment.

Identifiers: 5-chlorouracil, 4-chlororesorcinol, Biocides.

To examine toxicity effects of chlorine on aquatic life as the chemical enters natural waters from secondary treatment systems and powerplants, survival, mortality and maturation of Daphnia magna when exposed to the chlorine-containing stable organics 5-chlorouracil and 4-chlororesorcinol were tested in concentrations of 0.01, 0.1, 1 and 10 mg/l. These chemicals were chosen because of their relatively high concentrations in secondary effluents, and because 5-chlorouracil is a pyrimidine analog of thymine and consequently has the potential for incorporation into genetic material. A dose-response relationship between 4-chlororesorcinol and mortality of Daphnia was found with all concentrations used, decreasing the time to LC-50. The 0.1 and 1 mg/l concentrations greatly increased the mortality rate. All concentrations of 5-chlorouracil did not affect survivorship. All concentrations of 4-chlororesorcinol lowered reproduction, with no reproduction occurring in the 1 and 10 concentrations. The lowest concentration of 5-chlorouracil stimulated reproduction with the higher concentrations indicating only a delay in onset of reproduction. The 5-chlorouracil experiment indicated a significant lowering of specific birth rates at all but the lowest concentration. The dichotomy of results for 5-chlororesorcinol between the survivorship and reproductive maturation

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

ration segments of the experiments show the need for using more than a single parameter, particularly the mortality response, when determining the potential effects on a population. (Auen-Wisconsin)
W77-09492

PHYTOPLANKTON PERIODICITY IN A NEW RESERVOIR, LAKE ANNA, VIRGINIA.
Virginia Polytechnic Inst. and State Univ., Blacksburg.
B. Armitage, and G. M. Simmons.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 1814-1819, 1975. 1 fig, 10 ref.

Descriptors: *Period of growth, *Phytoplankton, *Dominant organisms, *Reservoirs, *Post-impoundment, Population, Seasonal, Ecological distribution, *Virginia, Fluctuations, Nuclear power-plants.
Identifiers: *Lake Anna(Va).

The type and degree of phytoplankton seasonal fluctuations in newly-filled Lake Anna, Virginia, were investigated. The reservoir and lagoon complex will serve as a coolant source for four nuclear power reactors. In addition to acidic Contrary Creek joining the North Anna River above the reservoir, effluent from a sewage treatment unit enters Lagoon 1 and runoff from a dairy cattle farm enters Lagoon 2A. The phytoplankton periodicities were representative of the greater portion of Lake Anna but other areas were atypical because of their allochthonous inputs. Increased enrichment was paralleled by increased cell volume per ml of water both in the reservoir and lagoons. The influx of Contrary Creek water induced low species diversity and the dominance by one species in comparatively large numbers. However, *Peridinium inconspicuum* reached its population maximum in Contrary Creek (pH 3.5-4.5) and Lagoon 1 (neutral pH, with allochthonous input) and in Lagoon 2B (neutral pH, no allochthonous enrichment) at the same time. No significant population of *P. inconspicuum* was present either in the reservoir or in Lagoon 2A during the same period. The dominant organisms are described. The anomaly evidenced by the occurrence of *Asterionella formosa* in the reservoir but not in the lagoons is not defined. (Auen-Wisconsin)
W77-09493

INTERACTIONS BETWEEN POPULATION DENSITY AND WATER QUALITY PARAMETERS DURING A DINOFLAGELLATE BLOOM.
T. H. Sibley, P. L. Herrgesell, and A. W. Knight.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 1820-1828, 1975. 6 fig, 2 tab, 14 ref.

Descriptors: *Dinoflagellates, *Reservoirs, *Water properties, Freshwater, *California, Water temperature, Conductivity, Dissolved oxygen, Hydrogen ion concentration, Euphotic zone, Nitrates, Biomass, Dominant organisms.
Identifiers: *Lake Berryessa(Calif), *Peridinium penardii*.

The effect of spring dinoflagellate blooms of *Peridinium penardii* (Lemm.) Lemm. fo. *californicum* Javorn on water properties were investigated in Lake Berryessa, a California reservoir. The most remarkable characteristics of the bloom are its discreteness, the magnitude of corresponding chemical differences that can be generated over small distances, and the maximum alteration caused by the bloom relative to the average conditions of the lake. Temperature, dissolved oxygen and pH correlated positively with population density while conductivity, nitrates and inorganic carbon correlated negatively. The bloom raised the dissolved oxygen from 10.6 mg/l to exceed 20.0 mg/l and the surface pH from 8.2 to 10.0 within the top of 0.5 m. While other parameters quickly recover from changes due to the *Peridini-*

um physiology, pH changes may persist longer; this may be deleterious to aquatic life. The mobile species might be able to avoid areas adversely affected but both biomass and species diversity of crustacean zooplankton were significantly decreased within the bloom. The blooms may remove nutrients from the water column so that they are not available for other algae species later. Although the blooms do not currently produce adverse effects, they may in the future, because indications show they are becoming more widespread and persistent annually.
W77-09494

AQUATIC BASELINE SURVEY OF SELECTED TEST AREAS ON EGLIN AIR FORCE BASE RESERVATION, FLORIDA.
Air Force Armament Lab., Eglin AFB, Fla.
For primary bibliographic entry see Field 7C.
W77-09499

PRODUCTION CYCLES IN AQUATIC MICROCOSMS.
California Univ., Berkeley. Lawrence Berkeley Lab.
A. Jassby, M. Dudzik, J. Rees, E. Laysaw, and D. Levy.
Available from the National Technical Information Service, Springfield, VA 22161 as LBL-5965, Price codes: A04 in paper copy, A01 in microfiche. Report No. LBL-5965, February 1977. 52 p., 7 fig., 3 tab., 41 ref. W-7405-ENG-48.

Descriptors: *Laboratories, *Microenvironment, Model studies, Aquatic environment, Ecosystems, Analytical techniques, Evaluation, Feasibility, Phytoplankton, Zooplankton, Trophic level, *Productivity, Nutrients, Catfishes, Snails, Oligochaetes, Midge, Protozoa.
Identifiers: *Microcosms, Mosquito fish.

Analogies between laboratory microcosms and natural water bodies were examined and major problems associated with the use of microcosms in environmental research are defined. Four 700-liter cylindrical containers were filled with demineralized water, enriched with nutrients, and inoculated with 3.5 liter lake water samples. The microcosms were maintained at a temperature of 18 C under a 12:12 L:D cycle for 6 months while their trophic structure was manipulated by the addition of snails, midge larvae, oligochaetes, mosquito fish, and catfish. Results demonstrated that temporal variation of the phytoplankton resembled the bimodal patterns of certain natural systems and there was a close analogy with predator-prey oscillations of temperate marine waters. Drawbacks encountered included: (1) size scaling problems such as shallow depths which result in higher sinking losses, smaller vertical irradiance changes, and smaller migration distances for zooplankton, (2) stocking planktonic fish in realistic concentrations, (3) poor replication and an unnaturally important role played by protozoa, and (4) high periphyton growth, leading to its dominance in the microcosms. Possible solution to the latter three problems are discussed, and modifications to increase the ability of the microcosms to simulate natural systems are suggested. (Luedtke-Wisconsin)
W77-09500

THE ECOLOGICAL BEHAVIOR OF PLUTONIUM AND AMERICIUM IN A FRESHWATER POND.
Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.
R. M. Emery, D. C. Klopfer, T. R. Garland, and W. C. Weimer.
Available from the National Technical Information Service, Springfield, VA 22161 as BNWL SA 5346, Price codes: A03 in paper copy, A01 in microfiche. Report No. BNWL-SA-5346, March 1975. 37 p. 8 fig., 4 tab., 24 ref.

Descriptors: *Absorption, *Ponds, *Radioactive waste disposal, *Nuclear wastes, Limnology, Food webs, Bottom sediments, Algae, Detritus, Nutrients, Invertebrates, Dragonflies, Biota, Distribution, Productivity, Connate water, *Washington, Aquatic plants, Radioecology.
Identifiers: *Plutonium, *Americium, Macrophytes, Goldfish, Hanford atomic plant(Wash), Bioaccumulation.

The limnology and ecological behavior of a freshwater pond used for the disposal of plutonium processing waste at the Hanford atomic plant, Washington, is examined. Waste disposal trenches leading to the shallow, highly eutrophic, 14-acre pond have received about 8.1 kg of Pu over a thirty-year period. It was found that a large portion of this discharge seemed to be retained in the trenches. Nutrient enrichment supplied by the laundry supported massive algae and macrophyte populations. A simple food web was found with algae, macrophytes, and to a large extent, detritus supplying the autochthonous carbon base. Predation was relatively minor, with dragonfly larvae the major predator. Non-predaceous invertebrates and goldfish were major omnivorous components, feeding primarily on detritus and live plant and algae tissue. Plutonium and americium were concentrated almost entirely in the sediments, and randomly distributed across the pond bottom. Algal floc was the major concentrator of Pu and Am. Watercress had similar Am levels. Although goldfish remained in the pond longer than any other fauna, they accumulated relatively small amounts of Pu and Am. The transuranics were made available and/or utilized by pond organisms in ratio which were not reflected by pond sediment concentrations. (Luedtke-Wisconsin)
W77-09501

CONTRIBUTIONS OF SUSPENDED AND DISSOLVED SUBSTANCES TO THE ARCTIC OCEAN DURING BREAKUP OF THE COLVILLE RIVER, ALASKA.
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
R. A. Hamilton, C. L. Ho, and H. J. Walker.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-025 318, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 203, January 1976. 30 p. 16 fig., 6 tab, 53 ref. NR 388 002, ONR N00014-69-A-0211-0003.

Descriptors: *Nutrients, *Arctic Ocean, *Suspended solids, *Melt water, *Rivers, Alaska, Arctic, *Primary productivity, Organic matter, Continental shelf, Carbon, Nitrogen, Phosphorus, Silica, Winter, Spring, Limiting factors, Coasts, Littoral, Shores.
Identifiers: *Colville River(Alaska), North Slope(Alas), Coastal waters.

In a study of riverine influences on primary productivity in near-shore ocean waters, samples were collected of suspended and dissolved substances contributed by the Colville River delta to the Arctic Ocean off northern Alaska. Extensive sampling in late winter, prior to ice breakup, during breakup and after breakup flooding provided information on the spatial distribution and temporal variation of dissolved and particulate organic carbon, nitrogen and phosphorus compounds, and silicon. Ice breakup flooding is a major contributor of mineral and organic matter to the ocean, significantly raising the inorganic nitrogen level and the ratio of inorganic nitrogen to phosphate-phosphorus to a proportion beneficial to primary production. Nitrogen is the limiting factor in arctic coastal waters. The contribution of dissolved silicate may also be significant for the growth of planktonic organisms such as diatoms which are important in the marine zooplankton food chain. The physiography of the Colville River drainage basin and the hydrography of the Beaufort seacoast and continental shelf are described. (Auen-Wisconsin)
W77-09503

COLUMBIA RIVER NUTRIENT STUDY-1972, Environmental Protection Agency, Seattle, Washington. Surveillance and Analysis Div. J. Hileman, R. Cunningham, and V. Kollias. Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 571. Price codes: A05 in paper copy, A01 in microfiche. Working Paper No. EPA-910-9-75-011, July 1975. 81 p. 21 fig., 7 tab., 8 ref., 1 append.

Descriptors: *Columbia River, *Tributaries, *Nutrients, Pacific Northwest U.S., Water quality, Nitrogen, Phosphorus, Dissolved oxygen, Hydrogen ion concentration, Temperature, Coliforms, Rivers, Water pollution sources, Watersheds(Basins).
Identifiers: *Nutrient loading.

Water quality aspects of the Columbia River and its tributaries were assessed to determine which tributaries had the greatest adverse influence on the Columbia River proper. Parameters evaluated included nitrogen ion concentration, with sources and ambient concentrations of nitrate and orthophosphate receiving special emphasis. It was found that nutrient loading levels in the Columbia River increased from the Canadian border to the mouth, with a relative variation of 1.7- to 20.0-fold for total nitrogen and 2.3- to 11.0-fold for total phosphorus, depending on the hydrologic quarter. The major proportion of nutrient loading came from tributaries. The Snake and Willamette Rivers together accounted for 56.5% to 80.2% of the total tributary nitrogen and 46.3% to 85.4% of the total tributary phosphorus. Based on annual average concentrations, orthophosphate-phosphorus exceeded the critical level for algae bloom potential at all Columbia River stations while nitrate-nitrogen exceeded the critical level at only one station. Temperature and total coliforms standards violations were observed at several Columbia River Stations. (Luedtke-Wisconsin).
W77-09504

ASPECTS OF PHOSPHATE UTILIZATION BY BLUE-GREEN ALGAE, Herbert H. Lehman Coll., Bronx, N.Y. T. E. Jensen, and L. Sisko-Goad. Report No. EPA-600/3-76-103, September 1976. 130 p., 109 fig., 7 tab., 211 ref. 1BA031, EPA R-800431-03-0.

Descriptors: *Cyanophyta, *Phosphates, *Plant physiology, *Metabolism, *Absorption, Cytological studies, Literature reviews, Eutrophication, Plant morphology, Cycling nutrients, X-ray analysis.
Identifiers: Plectonema boryanum, Polyphosphates, Luxury uptake.

The ability of cyanophytes to bloom at very low phosphorus levels, suggesting a mechanism which makes the plants extremely efficient in taking up phosphorus at very low concentrations, was investigated with cultures of Plectonema boryanum to determine the physiological and cytological responses of the algae during phosphate limitation and phosphate excess. P. boryanum tolerates phosphate concentrations from 1 to 1000 mg/l. Growth changes the subcellular distribution of phosphorus-containing compounds and induces ultrastructural changes. Cultures in phosphate-free or P-deficient media reduces phosphate in all cell fractions, with the most dramatic decrease in both short- and long-chain polyphosphates. Phosphate starvation induces development of cytological areas of medium electron density and vacuolization resulting from expansion of intrathylakoidal spaces. Inoculation of the phosphate-starved algae into a medium with phosphate increases all phosphorus-containing fractions, particularly both the short and long-chain polyphosphates within an hour. The polyphosphate bodies consist of phosphorus and calcium. The algae is unable to utilize condensed phosphate without its prior hydrolysis to orthophosphate. A literature review includes discussions of biological occurrence of

polyphosphate, parameters affecting active phosphate uptake, microscopy of polyphosphate bodies, aspects of phosphate metabolism, phosphagen hypothesis vs. phosphate storage, polyphosphate as a phosphorus reserve, ecological aspects of phosphorus in waters, nutrient sources in aquatic ecosystems, and hydrolysis of condensed phosphates. (Auen-Wisconsin)
W77-09505

DEGRADATION OF PARATHION IN SEA-WATER, Institut fuer Meeresforschung, Bremerhaven (West Germany).
For primary bibliographic entry see Field 5B.
W77-09506

PHYTOPLANKTON OF LAKE RUSALKA (POLAND), (IN POLISH), Adam Mickiewicz Univ., Poznan (Poland). Inst. of Systematic Geography and Plant Protection. For primary bibliographic entry see Field 2H.
W77-09507

EUTROPHICATION POTENTIAL OF DAIRY CATTLE WASTE RUNOFF, Logan, Utah Water Research Lab., Logan. D. S. Filip, and E. J. Middlebrook. Water Research, Vol. 10, No. 1, p 89-93, 1976. 6 fig., 13 ref. USAID/csd-2459.

Descriptors: *Eutrophication, *Feed lots, Nutrients, Nitrogen, Phosphorus, Carbon, Runoff, Agricultural runoff, Bioassay, Toxicity, Cattle, Chemical analysis, *Farm wastes.
Identifiers: *Beef cattle, *Dairy cattle.

The biostimulatory properties of dairy cattle feedlot runoff were studied and the differences between the biostimulatory properties of beef cattle and dairy cattle feedlot runoff were characterized. The characteristics of dairy cattle waste runoff were evaluated utilizing standard bottle test algal bioassays correlated with chemical analysis for growth limiting nutrients. Results showed that this runoff was extremely rich in nutrients, stimulating prolonged heavy algal growth in very dilute concentrations. Low inorganic nitrogen to phosphorus ratios of about 8:1 were found, indicating that nitrogen is first to limit algal growth in most feedlot runoff. In concentrated solutions, biostimulation was inhibited by toxins which seemed indigenous to concentrated runoff water. Analysis of samples for heavy metals indicated that metal concentrations were apparently inadequate to cause toxicity. Because topography and animal numbers differed between dairy cattle feedlots and previously studied beef cattle feedlots, exact comparisons were not possible. However, it was found that the chemical nature of the more concentrated dairy cattle was consistent, whereas the water chemistry of the more dilute beef cattle runoff changed suddenly in response to cattle density near streams. (Luedtke-Wisconsin)
W77-09509

FILAMENT FORMATION IN THE DIATOM SKELETONEMA COSTATUM, University of Southern Mississippi, Hattiesburg. Dept. of Biology. H. L. Housley, R. W. Scheetz, and G. F. Pennoney. Protoplasma, Vol. 86, No. 4, p 363-369, 1975. 12 fig., 10 ref.

Descriptors: *Diatoms, *Cytological studies, *Marine algae, Plant morphology.
Identifiers: *Skeletonema costatum.

Intercellular bands of wall material were discovered as a component in the cell morphology of the marine diatom morphology of the marine diatom, Skeletonema costatum. Electron microscopic examinations showed that the cells are

joined by open gutter-like spines (strutted tubuli) which form the margin of the valve face. The intercellular spaces occupied by tubuli are alternately enclosed by finely perforated bands (0.01 micrometer in diameter) of wall material. The intercellular bands are in the form of overlapping, open ended cylinders attached to the epitheca in the region of the cell girdle. Although newly-formed tubuli and closed, they are open or gutter-like in older filaments. The bands encircle only alternate sets of tubuli and the bands consist of two open ended cylinders which overlap in the intercellular area. The role of the intercellular wall material is uncertain; it may contribute to the mechanical stability of the filament by reducing fragmentation of the junction of tubuli. (Auen-Wisconsin)
W77-09510

SEGMENTED POPULATION MODEL OF PRIMARY PRODUCTIVITY, NUS Corp., Pittsburgh, Pa. Ecological Science Div. G. C. Slawson, and L. G. Everett. Journal of the Environmental Engineering Div., Proceedings of the American Society of Civil Engineers, Vol. 102, No. EE1, p 127-138, February 1976. 7 fig., 4 tab., 16 ref.

Descriptors: *Primary productivity, *Algae, *Mathematical models, Equations, *Nevada, Estimating, Regression analysis.
Identifiers: *Lake Mead(Nev), Algal population model.

As part of a study focused on development of models usable for predicting effects of changes in environmental factors such as nutrient inputs in aquatic ecosystems, a primary productivity model was developed for Lake Mead, Nevada, on the basis of division levels of algal populations. The algal divisions considered were Chlorophyta, Bacillariophyta, Chrysophyta, Cryptophyta and Cyanophyta. It was formulated on Michaelis constants (as adapted from the literature) of temperature in degrees Celsius, nitrogen in Mg/l as nitrates, phosphorus in mg/l as phosphate, and light, in calories/sq m per day, providing initial input coefficients. Multiple linear regression analysis utilizing these coefficients yielded a set of values for the optimal productivity rate for the six algal divisions. The main assumption in the formulation was the postulation of an optimal photosynthetic productivity rate, for an optimal temperature, optimal supplies of nutrients and light, and absence of competition for light and nutrients. For Lake Mead, total algal productivity rates were adequately approximated as the sum of the activity of each algal division, thus eliminating the need for detailed information at the species level. (Auen-Wisconsin)
W77-09512

A SPECIES OF STYLOSCOLEX MICHAELSEN (OLIGOCHAETA, LUMBRICULIDAE) FOUND IN TWO LAKES IN NORTHERN ALASKA, Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology. C. Holmquist.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A003 882. Price codes: A02 in paper copy, A01 in microfiche. Internationale Revue der Gesamten Hydrobiologie, Vol. 59, No. 1, p 49-55, 1974. 4 fig., 1 tab., 14 ref. ONR-412:8, ONR N 00014-70-A-0219-0001.

Descriptors: *Systematics, *Oligochaetes, *Ecological distribution, Worms, *Alaska, Arctic, Benthos, Invertebrates, Varieties, Phylogeny.
Identifiers: Styloscolex, *Lumbriculus, *Styloscolex opisthothecus.

Although the oligochaete Styloscolex had been thought of as restricted to Lake Baikal (U.S.S.R.), it has also been found in the vicinity of Sapporo on

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Hokkaido, Japan, and in Kamchatka and Manchuria. This genus has now been found also in two Alaskan lakes and is classified as *Styloscolex opisthothecus*. *St. opisthothecus* was not abundant, as out of one hundred lakes investigated, the species was found in only two lakes, Noluck and Ikmaarak. The finding of *St. opisthothecus* in Kamchatka and Alaska, together with finds of *St. japonicus* in Japan and *St. tetrathecus* in Manchuria, indicate its wide geographical distribution. A conclusion would be that all the known *Styloscolex* species may be fairly hardy as regards temperature. Winter is hard in all the areas where it has been found, and the rather shallow habitats cool down close to freezing for long periods. (Auen-Wisconsin)
W77-09513

PROBLEMS WITH RADIOMETRIC COLIFORM ASSAYS.
Framingham State Coll., Mass. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W77-09514

PHYTOPLANKTON OF LAKE MALTA (POLAND) (IN POLISH).
Adam Mickiewicz Univ., Poznan (Poland). Institute of Systematic Geography and Plant Protection.
B. Stefko.
Poznan Tow Przyj Nauk Wydz Mat-Przyr Pr Kom Biol 42, p 55-102, 1976.

Descriptors: *Artificial lakes, *Phytoplankton, *On-site investigations, Lakes, *Diatoms, Organic matter, Biorhythms, Distribution patterns, Productivity, Eutrophication, Systematics, *Chlorophyta, *Cyanophyta, Seasonal.
Identifiers: Cryptomonas, *Lake Malta (Poland), Oscillatoria agardhi, Phragmites communis, *Poland, Seasonal changes, Sanitary conditions.

Phytoplankton investigation in artificial Lake Malta were established on the shore of the River Warta within greater Poznan (Poland) for recreation, sport, aesthetics and improvement of the microclimate. During the 13 yr which have elapsed since the 1st elaboration, visible changes in vascular vegetation have been observed, e.g., the appearance of *Phragmites communis* and its dominance over 1/4 of the length of the shore. There was a reduction of water pollution by organic matter, probably because the brook Piasnica has been redirected to the stream Obrzyca, debouching directly into the river Warta. Phytoplankton were taken (398 algal taxa) at 3 points on the lake in 1969/70. The greatest number of taxa are diatoms; less are Chlorophyceae. Although Cyanophyceae are represented by a smaller number of taxa, they play an important role in the reservoir. In summer Cyanophyceae dominate, especially *Oscillatoria agardhi*. In autumn Cyanophyceae and, in Nov. in connection with a temperature decrease, diatoms dominate. In winter only *Cryptomonas* bloomed, in spring diatoms and Cyanophyceae bloomed. An attempt was made to characterize the sanitary conditions of the reservoir. Comparing changes in the phytoplankton of Lake Malta with those observed in Lake Rusalka in the same period, an increase of taxa and an increase of abundance was noted in both reservoirs, as well as a progressing eutrophication. In Lake Malta this process is less distinct, probably owing to the suppression of 1 of the pollution sources (*Piasnica* Brook).—Copyright 1977, Biological Abstracts, Inc.
W77-09515

LAKE DRAWDOWN AS A METHOD OF IMPROVING WATER QUALITY.
Florida Univ., Gainesville.
For primary bibliographic entry see Field 5G.
W77-09516

THE DYNAMICS OF AN ESTUARY AS A NATURAL ECOSYSTEM.

South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
F. J. Vernberg, R. Bonnell, B. Coull, R. Dame Jr., and P. De Coursey.
Available from the National Technical Information Service, Springfield, VA 22161. Ecological Research Series EPA-600/3-77-016, January 1977. 94 p., 9 fig., 10 tab., 169 ref. 1EA615. R 802928

Descriptors: *Estuaries, *Ecosystems, *Salt marshes, *Baseline studies, *Energy transfer, *South Carolina, Productivity, Mathematical models, Oysters, Algae, Zooplankton, Food chains, Microbial degradation, Solar radiation, Hydrography, Laboratory tests, Benthos, Data storage and retrieval.
Identifiers: *North Inlet Estuary (SC), *Estuarine energetics, *Salt marsh energetics.

The results of the first two years of study of equilibrium and change in an undisturbed estuary-marshland ecosystem, the North Inlet Estuary near Georgetown, South Carolina, are presented as a baseline for comparison of the effects of various pollutant stresses on estuarine environments. A substudy developed a conceptual model of energy flow for the entire ecosystem, with three subsystems representing the water column, the intertidal marsh zone and the benthic subtidal zone. Another substudy simulates an intertidal oyster community by a linear systems model. The data collection methods and retrieval systems are described. Detailed studies were collected on the phytoplankton and microbenthic algae; the composition, and seasonal dynamics of the zooplankton; vertical migration of crab larvae as related to the food chain energy transfer; and light, diurnal migration and metabolism of the crab larvae, *Uca pugnator*. Data were also compiled on the abundance, diversity and respiration of the macrobenthic fauna and on microbial decomposers. The radiation balance in North Inlet Marsh was computed together with details of the hydrography of North Inlet. The design and replicability of laboratory salt marsh microecosystems to assess perturbations caused by pollutants are described. (Auen-Wisconsin).
W77-09517

ON ALEXANDROVIA ONEGENSIS HRABE FROM ALASKA, WITH A REVISION OF THE TELMATODRILINAE (OLIGOCHAETA, TUBIFICIDAE).
Naturhistoriska Riksmuseet, Stockholm (Sweden). Section for Invertebrate Zoology.
C. Holmquist.

Available from the National Technical Information Service, Springfield, VA 22161 as ADA-003 884. Price codes: A02 in paper copy, A01 in microfiche. Zoologische Jahrbuecher, Abteilung fuer Systematik Oekologie und Geographie der Tiere, Vol. 101, p.249-268, 1974. 13 fig, 1 tab, 21 ref. ONR-412:9, ONR N 00014-70-A-0219-0001.

Descriptors: *Speciation, *Oligochaetes, *Tubificids, *Ecological distribution, Arctic, *Alaska, Invertebrates, Lakes.
Identifiers: *Alexandrovina onensis Hrabce, Telmatodrilus mcgregori, Telmatodrilus multiprostatatus, Telmatodrilus pectinatus.

Discovery of the tubificid worm *Alexandrovina onensis* Hrabce (in seven lakes) in northern Alaska lakes has resulted in the revision of the subfamily Telmatodrilinae and the genus *Telmatodrilus* mcgregori Eisen. The genera *Telmatodrilinae* and *Alexandrovina* represent worms so different from each other that they cannot be considered synonymous. Two Tasmanian species, *Telmatodrilus multiprostatatus* Brinkhurst and *Telmatodrilus pectinatus* Brinkhurst probably do not belong to this or to the *Alexandrovina* genera but poor specimens precluded definitive classification. The distribution and ecology of the worms are summarized. No common denominator among

ecological factors of the various lakes which elucidate any demands on *A. onensis* have been found to date. (Auen Wisconsin)
W77-09518

USER'S MANUAL FOR THE M.L.T. TRANSIENT WATER QUALITY NETWORK MODEL—INCLUDING NITROGEN-CYCLE DYNAMICS FOR RIVERS AND ESTUARIES.
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-09519

THE USE OF WETLANDS AS NUTRIENT REMOVAL SYSTEMS.
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5G.
W77-09520

BIODEGRADATION OF CELLULOSIC SUBSTRATES.
Louisiana State Univ., Baton Rouge.
For primary bibliographic entry see Field 5B.
W77-09522

THE SEDIMENTS OF LAKE GEORGE (UGANDA). II: RELEASE OF AMMONIA AND PHOSPHATE FROM AN UNDISTURBED MUD SURFACE.
Malaya Univ., Kuala Lumpur (Malaysia). School of Biological Sciences.
A. B. Viner.
Archiv fur Hydrobiologie, Vol 76, No 3, p 368-378, 1975. 4 fig, 11 ref.

Descriptors: *Sediment-water interfaces, *Mud-water interfaces, *Adsorption, Lakes, Phosphates, Ammonia, Aerobic conditions, Nitrification, Africa, *Lake sediments.
Identifiers: *Lake George (Uganda), *Nutrient release.

Investigations were made into the liberation of nitrogen and phosphate to the waters of Lake George, Uganda from undisturbed surface muds to obtain an indication of the minimal amounts which might be contributed by the sediments. Laboratory experiments compared aerobic to anaerobic muds either poisoned or non-poisoned, so as to distinguish biogenic from non-biogenic phenomena. A conclusion was reached that biological mineralization was low, so that non-biogenic equilibria were more likely to control the release of nutrients and that this would be dependent on the nutrient concentration in the superficial mud. Concentrations of nitrogen and phosphate are low in this layer, and experimental release of the nutrients into the interstitial water of the mud showed that this release was very slow relative to the potential demands by the primary producers. It was therefore thought that the sediments contribute proportionately little to the nutrient recycling of the lake. (See also W77-00712) (Harris-Wisconsin)
W77-09523

EFFECTS OF THREE ENVIRONMENTAL VARIABLES ON SULFATE UPTAKE BY AEROBIC BACTERIA.
New York State Museum and Sciences Service, Albany.
R. H. Monheimer.
Applied Microbiology, Vol 30, No 6, p 975-981, December, 1975. 5 fig, 1 tab, 16 ref. NSF BMS75-03352.

Descriptors: *Aerobic bacteria, *Sulfates, *Absorption, Organic matter, Laboratory tests, Productivity, Pseudomonas.
Identifiers: *Pseudomonas fluorescens*, *Corynebacterium striatum*, *Serratia marcescens*.

Evidence is presented which indirectly links the uptake of sulfate and organic carbon by aerobic bacteria, reinforcing the belief that sulfate uptake can be used as an indicator of microbial biomass production in freshwater ecosystems. Pure cultures of *Pseudomonas fluorescens*, *Corynebacterium striatum* and *Serratia marcescens* in defined media indicated that uptake of glucose and other organic substrates by bacteria is an active metabolic process such that, as the concentration of these substrates increases, the rates at which they are taken up also increase, but only up to some maximum concentration above which uptake rates remain constant. Thus, if some metabolic relationship exists between the uptake of the sulfate and the uptake of organic carbon, then when bacteria are subjected to a constant sulfate uptake increases but only up to some maximum organic carbon concentration. The *P. fluorescens* and *C. striatum* cultures took up sulfate faster when young, but sulfate uptake by *S. marcescens* was faster in older cultures. Organic sulfur was found to decrease sulfate uptake, but at concentrations somewhat higher than occur in most freshwater ecosystems. Low levels of sulfate can theoretically limit bacterial biomass production but this limitation is unlikely in natural systems. (Auen-Wisconsin)

W77-09524

OCCURRENCE OF OSCILLATORIA AGARDHII GOM. IN SOME SHALLOW EUTROPHIC LAKES, C. Berger.

Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2689-2697, 1975, 4 fig, 2 tab, 17 ref.

Descriptors: *Nuisance algae, *Organic matter, Carbon, *Eutrophication, Europe, Phosphorus, Plant ecology, Nutrient requirements, Impoundments, Artificial lakes.

Identifiers: *Flevoland (Netherlands), *Oscillatoria.

Investigations of the occurrence of *Oscillatoria agardhii* and *O. rubescens* in five shallow, eutrophic impoundments bordering the polder Flevoland in the Netherlands, are detailed. All lakes received domestic effluents and one, the Wolderwijd, received dairy wastes. The phosphorus load to the Drontermeer and the Veluwemeer was about 4 to 5 g P/sq m/yr; Wolderwijd probably received less than 3 g P/sq m/yr, and the Eemmeer and Gooimeer received 20-30 g P/sq m/yr. The striking fact noted in the investigation was the constant presence of *O. agardhii* in Wolderwijd—the lake which receives only dairy wastes and with the smallest phosphorus load, and its sudden disappearance from the Eemmeer and Gooimeer during a period of diminishing supply of organic matter. The role of organic matter as a carbon source seems very important although it is not known how much organic compounds as a carbon source are necessary for these algae when there is 16 mg carbon as carbonates and carbon dioxide, a pH of 9.0 and gross production of 5 mg C/L. The apparent requirement for organic compounds by *O. rubescens* in an environment with high inorganic carbon concentrations may be that organic matter supplies more than pure carbon. Or perhaps organic matter is relatively more important when illumination is low. (Auen-Wisconsin)

W77-09525

EFFECT OF CRUDE OIL ON POPULATIONS OF BACTERIA AND ALGAE IN ARTIFICIAL PONDS SUBJECT TO WINTER WEATHER AND ICE FORMATION,

D. B. Shindler, B. F. Scott, and D. B. Carlisle. Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 2138-2144, 1975, 6 fig, 2 tab, 12 ref.

Descriptors: *Freshwater, *Oil spills, *Water pollution effects, *Bacteria, *Algae, Model studies, *Canada, Ice cover, Winter.

Identifiers: Crude oil pollution, Hydrocarbons.

As part of an effort to study effects of crude oil spills on microorganisms in natural freshwater, effects of a winter Norman Wells crude oil spill on bacteria, algae and the chemical events which occur in lentic waters were investigated in artificial enclosures near the Ottawa River (Canada). The control and test ponds all contained *Flavobacterium* (including *Cytophaga* and *Xanthomonas*) and *Caulobacter*. Just after the ice melted and the oil contacted the water *Arthrobacter* became numerous. About three weeks later, in the under the ice application, a *flavobacterium* increased. When the water warmed *Caulobacter* again proliferated. Algae were most numerous in the heavily-oiled pond and least numerous in the control pond, with either N or P growth-limiting. Nitrate increased to high levels during summer in the oiled ponds. Although the multiple factors involved make it difficult to predict the kind of bacterial selection or enrichment which will take place with oil additions, after the oil contacts the water, an initial selection of one or a few bacterial types will take place, followed by greater diversity; the initial bacteria population was similar to types which degrade crude oils. The ponds did not become anaerobic. Obligate aerobes such as *Axotobacter* seemed to thrive under the oiled conditions. Aerobic nitrogen-fixing bacteria may have altered the N:P ratio, contributing to an increased rate of eutrophication. (Auen-Wisconsin)

W77-09526

POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN.

Environmental Protection Agency, Washington, D.C. Water Quality Office. For primary bibliographic entry see Field 5G.

W77-09528

DOES SALINITY INFLUENCE THE NUMBER OF VERTEBRAE DEVELOPING IN FISHES,

North Carolina Univ. at Chapel Hill. Inst. of Marine Sciences. W. E. Fahy, and R. K. O'Hara. International Council for the Study of the Sea, Journal du Conseil, Vol. 37, No. 2, p. 156-161, February 1977, 2 tab., 28 ref.

Descriptors: *Salinity, *Environmental effects, *Fish physiology, *Killifishes, *Fish, *Embryonic growth stage, Laboratory tests, Metabolism, Reviews, Water quality, Growth stages.

Identifiers: *Vertebral number, *Fundulus.

Using the cyprinodontid fish, *Fundulus majalis*, five lots of 44 embryos each were reared in jars from gastrulation to hatching in a controlled-temperature room at five different salinities (16, 21, 26, 31 and 36‰). Comparisons of mean vertebral counts show no statistically significant differences occurring between them and thus no salinity influence upon vertebral number is indicated. The literature from the field of salinity influence upon vertebral number in fishes is reviewed and it is concluded that there is little evidence, from the field or the laboratory, to support the generally expressed acceptance of salinity as an important environmental factor known to modify vertebral number in developing fishes. (Katz)

W77-09529

AN AUTOMATIC SYSTEM FOR RAPID DETECTION OF ACUTE HIGH CONCENTRATIONS OF TOXIC SUBSTANCES IN SURFACE WATER USING TROUT,

Netherlands Waterworks, Rijswijk. Testing and Research Inst. For primary bibliographic entry see Field 5A.

W77-09590

THE IMPORTANCE OF MONITORING CHANGE,

Academy of Natural Sciences of Philadelphia, Pa. For primary bibliographic entry see Field 5A.

W77-09591

SOME DISSENTING REMARKS ON 'DELETERIOUS EFFECTS OF COREXIT 9527 ON FERTILIZATION AND DEVELOPMENT',

Exxon Research and Engineering Co., Florham Park, N.J. G. P. Canevari, and G. P. Lindbloom. Marine Pollution Bulletin, Vol. 7(7), 1976, p 127-128, 1 tab, 10 ref.

Descriptors: *Toxicity, *Bioassay, Mortality, Laboratory tests, Laboratory animals, Water pollution effects, Waste disposal, Oil, Oil spills, Dispersion, Sea water.

Identifiers: *Corexit 9527, Water soluble chemical dispersant.

The article discusses the relevance of laboratory toxicity studies of a chemical oil dispersant in general. While Lonning and Hagstrom use a sensitive means to determine the more subtle, sublethal effects of chemicals on marine life, two major aspects of their work should be clarified. First, a concentration of 1-10 ppm of chemical dispersant, wherein fertilization of the sea urchin egg was affected in their work, does not occur in the usual marine environment with proper use of the dispersant. Second, there is no evidence to support the conclusion that the specific chemical dispersants studied by Lonning and Hagstrom preferentially release 'toxic substances' from the crude oil. (See W75-11091 and W75-11090) (Katz)

W77-09593

EFFECTS OF ANAEROBICALLY DIGESTED SEWAGE SLUDGE ON ORGANIC MATTER IN SOIL AND SOIL WATER,

Illinois Univ. at Urbana-Champaign. G. N. Hohla. Ph D Thesis, 1976, 101 p.

Descriptors: *Sludge disposal, *Sludge digestion, *Soil types, *Anaerobic treatment, *Leachate, Carbon, Nitrogen, Analysis, Organic matter, Disposal.

Identifiers: Land application.

A six-year study was conducted to determine anaerobically digested sludge effects on soil and soil water organic matter. Lysimeters containing Blount silt loam and Plainfield loamy sand were furrow irrigated with the sludge. Lysimeter leachate waters and Blount silt loam leachate waters were also studied. Total organic carbon, carbohydrate carbon, oil and grease carbon, and organic nitrogen were determined in the soils and lysimeter leachate waters. Blount silt loam leachate waters were characterized using infrared and ultrafiltration techniques. Results indicated that the coarse textured soil (Plainfield loamy sand) had a higher oxidation rate for sludge organic carbon and a higher leaching potential than fine textured Blount silt loam. Drainage is important in controlling oxidation rate of sludge organics in soils. Long-term sludge application caused an organic compounds distribution shift in the plow layer towards that of applied sludge. Finally, long-term sludge land application by ridge and furrow irrigation produces a relatively large organic carbon loss to oxidation, and a low potential loss to leaching. (Collins-FIRL)

W77-09598

5D. Waste Treatment Processes

THE EFFECTS OF CHILI WASTE ON AN ACTIVATED SLUDGE PROCESS,

New Mexico State Univ., University Park. Dept. of Civil Engineering. J. L. Gabbard.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 335. Price codes: A08 in paper copy, A01 in microfiche. Master of Science Thesis, June 1974. 54 p, 11 fig, 5 tab, 6 ref. OWR T A-047-NMEX(1).

Descriptors: *Activated sludge, *Chemical oxygen demand, Sewage, *Sewage treatment, Trickling filters, Anaerobic digestion organic loading, *Waste water treatment, Industrial wastes. Identifiers: Chili, *Chili wastewaters.

A bench scale model of a completely mixed activated sludge system consisted of a primary clarifier, a completely mixed activated sludge unit, and a secondary clarifier. The activated sludge unit was rectangular with effluent flow over a single weir. Aeration and mixing were accomplished by compressed air injection. System performance was evaluated with sewage and chili waste influents while attempting to hold all other operational parameters constant. The mode of system evaluation was efficiency of COD removal by secondary treatment. Chili waste is highly degradable by aerobic microorganisms and is at least as susceptible to treatment by activated sludge as sewage. A completely mixed activated sludge system suffers only a mild upset from shock loading with chili waste and has a quick recovery from the upset. (Hain-NMEX State) W77-09141

OPTIMAL ARTIFICIAL AERATION DESIGN IN POLLUTED STREAMS RECEIVING THERMAL DISCHARGE,
Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
For primary bibliographic entry see Field 5G.
W77-09146

OPTIMAL ARTIFICIAL AERATION POLICY FOR WATER QUALITY CONTROL OF STREAMS RECEIVING MULTIPLE THERMAL AND SEWAGE DISCHARGES,
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W77-09147

AN OVERLAND FLOW - LAGOON RECYCLE SYSTEM AS A PRETREATMENT OF POULTRY WASTES,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Soil Science.
M. R. Overcash, J. W. Gilliam, and F. J. Humenik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 317. Price codes: A02 in paper copy, A01 in microfiche. Paper given at Third International Symposium on Livestock Wastes, ASAE, Urbana-Champaign, Ill., Apr. 1975, 14 p, 2 fig, 4 tab. OWR T B-067-NC(1), 14-31-0001-4113.

Descriptors: *Overland flow, Poultry, *Waste water treatment, *Recycling, Nitrogen, Phosphorous, Agricultural wastes, Nutrient removal, Farm wastes, Water reuse, Pretreatment(Water), North Carolina. Identifiers: *Poultry wastes, Nitrogen removal, Phosphorous removal.

A field installation for overland flow was designed as a liquid recycling pretreatment facility for waste from a caged poultry house. Investigations were made to (1) evaluate the overland flow distance required to achieve varying levels of treatment as measured by chemical oxygen demand (COD), total organic carbon (TOC), nitrogen removal or conversions, and phosphorous transformation; (2) determine the pathways and amount of nitrogen removed per unit area in an overland flow animal waste pretreatment system; (3) evaluate the plant-soil system response to alternative loading strate-

gies of animal waste. Significant reductions were obtained in the concentration of organics, nitrogen and phosphorous. Greater removal of COD occurred than TKN, with phosphorous removal the least efficient. Distance needed for overland flow will probably be less than 45 m for animal waste systems because of declining removal percentages found after 15 m of treatment. Good grass growth occurred and effective soil sealing was achieved and promoted runoff rather than downward movement. (See also W76-11775)
W77-09148

COST-EFFECTIVE ANALYSIS OF WASTE LOAD ALLOCATIONS,
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5B.
W77-09167

PATUXENT RIVER BASIN MODEL RATES STUDY,
Environmental Protection Agency, Annapolis, Md. Annapolis Field Office.
For primary bibliographic entry see Field 5B.
W77-09170

EFFICIENT STORAGE OF URBAN STORM WATER RUNOFF,
Environmental Protection Agency, Denver, Colo.
J. R. Doyle, J. P. Heaney, W. C. Huber, and S. M. Hasan.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 139-143, July 1976. 1 fig, 2 tab, 8 ref.

Descriptors: *Storm water, *Detention reservoirs, *Linear programming, *Flood plains, *Evaluation, *Alternative planning, Optimization, Storage reservoirs, Costs, Florida, Decision making, Urban runoff, Equations, Mathematical models, Systems analysis. Identifiers: *Mixed integer programming, Cost minimization, Drainage basins.

Mixed integer linear programming is used to evaluate alternatives for use of storm water detention in flood plains and developing areas. This model is suitable where a refined analysis is needed. Mixed integer programming is appropriate when it is necessary to handle fixed charge problems. This added feature significantly increases the computational complexity of the model as compared to standard linear programming procedures. Given an inventory of available storage sites, both in and out of the flood plain, and costs for other flow reduction measures, the optimization model determines the least costly combination of storage reservoirs. Application to the Hogtown Creek drainage basin in Gainesville, Florida is included to demonstrate the techniques. In solving the problem, the model allocates the specified total potential runoff volumes from each subbasin among the subbasin and flood plain storage sites, while allowing only a specified volume of runoff to flow downstream. All storage allocations and costs are given. Results show that the fixed costs for providing storage within the flood plain and the subbasin are a small percentage of the total costs. (See also W77-09154) (Bell-Cornell)
W77-09171

JOINT USE OF SWMM AND STORM MODELS FOR PLANNING URBAN SEWER SYSTEMS,
Clinton Bogert Associates, Fort Lee, N.J.
H. L. Kaufman, and F.-H. Lai.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 144-150, July 1976. 8 fig, 1 tab, 10 ref.

Descriptors: *Simulation analysis, *Sewers, *Planning, *Computer models, Flood control, *Water quality control, Design storm, Hydrographs, Hyetographs, Infiltration, Pollution abatement, Runoff, Systems analysis, Costs. Identifiers: Cost effective.

The joint use of the SWMM and STORM simulation models has been demonstrated to provide a tool for sewer system planning which effectively alleviates urban flooding and prevents pollution in the receiving waters. Techniques were developed for projection of runoff characteristics from one drainage district to others for citywide sewer planning. A concept making use of the characteristics of runoff quantity and quality and interceptor capacity for cost-effective pollution control is described. The pollutants discharged to receiving waters for various interceptor capacities have been comparatively quantified. (See also W77-09154) (Bell-Cornell)
W77-09172

RADIONUCLIDE REMOVAL BY THE PH ADJUSTMENT OF PHOSPHATE MILL EFFLUENT WATER,

Eastern Environmental Radiation Facility, Montgomery, Ala.
D. L. Norwood, and J. A. Broadway.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 264-268, July 1976. 2 fig, 1 tab, 5 ref, append.

Descriptors: *Waste water treatment, *Water quality control, *Phosphates, *Industries, *Computer models, Flow rates, Evaluation, Effluents, Equations, Systems analysis, *Radioisotopes. Identifiers: *Wet process plant.

Application of the GASP IV computer simulation system to the waste water treatment process in a phosphate ore milling industry is presented. Specific attention is directed to a quantitative evaluation of precipitation of radionuclides due to the limiting treatment (pH adjustment) used in a wet process plant and the residual radionuclides in effluent water. The variation in output radionuclide concentrations has been studied as a function of important system parameters such as flow rate, limiting rate, and pH. Extension of this modeling capability to other large industrial applications is discussed and implications for further study are indicated. As more information is gathered concerning the phosphate plant release to the process water pond and its behavior in that pond, this model can be used to determine the optimal volumetric flow rate. (See also W77-09154) (Bell-Cornell)
W77-09180

MODIFICATIONS TO QUAL - II TO EVALUATE WASTEWATER STORAGE,
Environmental Protection Agency, Atlanta, Ga. Technical Support Branch.
J. S. Tapp.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 350-352, July 1976. 5 fig, 3 ref.

Descriptors: *Water quality control, *Simulation analysis, *Computer models, *Model studies, Streamflow, Waste water(Pollution), Storage, Flow, Effects, Low flow, Water temperature, Treatment facilities, Waste water treatment, Standards, Seasonal, Systems analysis, *Dissolved oxygen. Identifiers: Receiving waters.

Effluent limitations for wastewater discharges are commonly established based on maximum tem-

perature at some critical statistical low streamflow condition, normally defined by water quality standards. For situations where assimilative capacity is limited and the storage of effluent from a wastewater treatment facility is feasible, the normal seasonal changes in water temperature and flow rates can be utilized to allow instream water quality standards to be maintained at a cost less than by utilizing treatment alone. To use the wastewater storage approach requires curves of streamflow versus wastewater flow at a given quality to maintain some instream constituent concentration, usually dissolved oxygen. Unfortunately, most dissolved oxygen models are not constructed so that these curves can be determined without much trial and error input and manipulation. Described are modifications to the Model QUAL-II to allow easy generation of curves of streamflow versus wastewater flow to maintain a given instream dissolved oxygen concentration. Situations which lend themselves to application of the modified model are discussed. (See also W77-09154) (Bell-Cornell)

W77-09186

WATER POLLUTION MODELING IN THE DETROIT METROPOLITAN AREA.

Detroit Water and Sewerage Dept. Mich.; and Wayne State Univ. Detroit, Mich. Coll. of Engineering.

For primary bibliographic entry see Field 5B.

W77-09187

GENERALIZED METHOD FOR EVALUATING URBAN STORM WATER QUALITY MANAGEMENT STORAGE/TREATMENT ALTERNATIVES.

Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.

J. P. Heaney, W. C. Huber, S. M. Hasan, and M. P. Murphy.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 358-361, July 1976. 3 fig, 1 tab, 16 ref.

Descriptors: *Water pollution control, *Simulation analysis, *Rainfall, *Runoff, *Computer models, Storm water, Management, Urban runoff, Pollutants, Estimating, Cost analysis, Optimization, Biochemical oxygen demand, Methodology, Evaluation, Storage, Treatment, Systems analysis.

Identifiers: Loading rates, Cost minimization.

Completion is near of an EPA-sponsored study in conjunction with the American Public Works Association to estimate the nationwide cost of controlling pollution from combined sewer overflows and storm sewer runoff. Two models, the USEPA Storm Water Management Model and the Corps of Engineers' STORM, were used extensively in this study to estimate pollutant loading rates and evaluate various storage/treatment alternatives. Detailed modeling studies were performed in Atlanta, Denver, Minneapolis, San Francisco, and Washington, D.C. This paper describes the results of continuous simulation of hourly rainfall and runoff in these cities for a wide variety of assumed availabilities of storage and treatment combinations. Results of these simulation studies are presented as isoquants showing the technologically efficient combinations of storage and treatment to obtain a specified per cent pollution control. This information is combined with cost data developed herein to determine the optimal combination of storage and treatment for any desired level of control for each of the five cities. The results are presented in a normalized form which enables engineers and planners to derive preliminary estimates of control costs for other cities. This information is useful for early phases of 20% planning and for NEEDS surveys. A more complete description of this procedure is presented elsewhere. (See also W77-09154) (Bell-Cornell)

W77-09188

CAPACITY EXPANSION FOR MUNICIPAL WATER AND WASTEWATER SERVICES: INCORPORATION OF UNCERTAINTY.

Curran Associates, Inc., Northampton, Mass.

R. G. Curran, D. S. Grossman, and D. H. Marks. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 639-645, July 1976. 1 tab, 46 ref.

Descriptors: *Municipal water, *Water supply, *Demand, *Model studies, *Investment, *Economic efficiency, Optimization, Linear programming, Alternative planning, Water shortage, Construction costs, Operations, Estimating, Decision making, Forecasting, Systems analysis, Waste water(Pollution), *Risks.

Identifiers: *Capacity expansion, Cost minimization, Penalty fees, Nonlinear programming.

Methods for the management of local water and wastewater investments are outlined. The strategy is to choose the least cost supply alternative that services a forecast but uncertain equilibrium demand. Careful attention is paid to the overall usability of the method by local planners. Linear and nonlinear models are categorized as to shortfalls, no shortfalls, certainty, and uncertainty. The research defines water and wastewater service demands, and identifies some controls available to local decision makers for modification of these demands. The level of future requirements for planning is uncertain; the form and magnitude of the uncertainty is explicitly included. Supply alternatives and forecast costs of supply are also presented. Forecasts are developed for local relevance and to best utilize available information. A detailed analysis of time phasing and scale of capacity expansion requires forecasts of the impact of supply shortage. Short term alternatives in shortage can either act to limit demand or to increase supply. Recommended cost assessment for these strategies is empirical. The criterion for expansion planning is to choose the alternative which minimizes total costs, where costs include construction, operating, and shortage penalty fees. The recommended expansions explicitly incorporate forecast uncertainty in the evaluation of alternative investment patterns. (See also W77-09154) (Bell-Cornell)

W77-09201

NEW MODELS FOR OPTIMAL SEWER SYSTEM DESIGN.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

B. C. Yen, H. G. Wenzel, Jr., L. W. Mays, and W. H. Tang.

Descriptors: *Sewers, *Design, *Economic efficiency, *Dynamic programming, *Model studies, Optimization, Routing, Hydrographs, Hydrology, Travel time, Installation costs, Manholes, Risks, Simulation analysis, Constraints, Illinois, Computer programs, Evaluation, Mathematical models, Equations, Systems analysis, Storm water.

Identifiers: *Cost minimization, Damage costs.

Considerable savings in sewer designs can be achieved by considering the sewers as a system and searching for the least-cost design using optimization techniques. Three new models have been developed for the minimum cost design of storm sewers. The basic model designs the crown elevations, slopes, and diameters of the sewers. The sewer system layout is predominant. Routing is accomplished by lagging the hydrographs by a travel time. Optimization is achieved through a discrete differential dynamic programming method to produce the least-cost design of the system based on specified cost functions for installation of the sewers and manholes. The second

model is an expansion of the basic model incorporating risk-based damage costs in the design procedure, and the risks for each sewer associated with the minimum cost design are also given as part of the design results. The third model is similar to the basic model except that the least-cost sewer layout is also a part of the design result instead of being predetermined. (See also W77-09154) (Bell-Cornell)

W77-09205

SWAN, A SEWER ANALYSIS AND MODELING SYSTEM.

Erdman Anthony, Associates. Rochester, N.Y.

E. C. Tonias, and P. C. King.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 750-754, July 1976. 1 fig, 11 ref.

Descriptors: *Sewers, *Networks, *Simulation analysis, *Computer programs, Decision making, Design, Hydrologic aspects, Hydrographs, Backwater, Mathematical models, Systems analysis, Storm water, Flow.

Identifiers: *Collection networks.

The need for a thorough understanding of the sewage collection systems for many municipalities has resulted in the development of a system of computer programs to analyze an existing network. This computer system, called SWAN (an acronym for Sewer Analysis), can be employed to examine the collection network as a whole or in part(s), thus enabling the investigators to see the total character of the network at a glance and to make coordinated decisions concerning expansion and improvement. SWAN can store an entire sewage collection network on a data base which easily can be modified and employs a mathematical model to simulate the network flows under various sanitary and storm conditions and combinations thereof. SWAN was originally based on the Rational Method. Recent modifications have incorporated the Surface Hydrograph Method commonly referred to as the Chicago Method. Although SWAN's primary purpose is to analyze existing sewer systems, it may be used as a design tool. The principle of design by iterative analysis is facilitated immensely by SWAN's built-in feature of recommending appropriate pipe sizes for upgrading inadequate sewer reaches. Graphic documents produced automatically by the computer system may be utilized as final report or contract documents. SWAN is ideally suited for a small (IBM-1130) computer readily available to many consulting engineering offices and small governmental agencies and municipalities. Although SWAN is intended for batch processing, it may easily be converted for an interactive environment. (See also W77-09154) (Bell-Cornell)

W77-09206

ON-LINE MODELS FOR COMPUTERIZED CONTROL OF COMBINED SEWERS.

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

J. W. Labadie, N. S. Grigg, and P. D. Trotta.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 755-759, July 1976. 4 fig, 10 ref.

Descriptors: *Combined sewers, *Automatic control, *Computers, *Forecasting, *Optimization, *Model studies, Pollutants, Discharge(Water), Flow, Overflow, Computer models, Rainfall-runoff relationships, Constraints, Dynamic programming, Algorithms, Digital computers, Equations, System analysis.

Identifiers: Minimization.

Automatic computer control is a cost-effective approach to controlling polluting discharges from

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

combined sewer systems. Perhaps the greatest challenge is development of programmable models and control logic that can find the best positioning of field control elements within the restriction of the on-line, real-time environment. Control strategies can be developed off-line or on-line, and may be reactive or adaptive. It appears that simple reactive control, or rule curves, can adequately control total overflows, but may produce high overflow rates. Stochastic adaptive policies produce a smoother distribution of overflows, but are highly dependent on the accuracy of the storm inflow forecasting model. Autoregressive moving-average transfer function models are proposed as an efficient approach to forecasting. Initial indications are that total city-wide automatic control is feasible, both technically and economically. A quantified control objective and mathematical specification of all pertinent constraints on system response, in conjunction with a systematic optimization algorithm for finding the best or nearest controls, is termed an optimizing model. Development of efficient, yet sufficiently accurate, optimizing models for on-line use remains a challenging area for future research. (See also W77-09154) (Bell-Cornell)

W77-09207

MATHEMATICAL MODELS FOR CALCULATING PERFORMANCE AND COST OF WASTE-WATER TREATMENT SYSTEMS, Municipal Environmental Research Lab., Cincinnati, Ohio. Systems and Economic Analysis Section.

R. G. Eilers.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 760-763, July 1976. 1 fig, 4 tab.

Descriptors: *Waste water treatment, *Computer programs, Costs, Estimating, Performance, Waste water (Pollution), Municipal wastes, Sewage, *Computer models, Activated sludge, Mathematical models, Systems analysis.

Identifiers: Minimum cost, Design variables.

The Systems and Economic Analysis Section of the Wastewater Research Division of EPA in Cincinnati, Ohio is concerned with finding quantitative expressions for calculating the performance and cost of wastewater treatment processes as a function of the nature of the wastewater to be treated and the design variables associated with the individual unit processes. These models are intended primarily to characterize the treatment of municipal sewage. Since the procedure for solving all of the quantitative equations is usually too laborious or complex to be accomplished by hand calculation, various FORTRAN computer programs have been developed to perform the task. A description in tabular form of the most significant of these programs is given. Discussed also are models for the activated sludge process and specialized cost estimating programs. In conclusion, the mathematical computer model can minimize the computational work required for examining alternative designs, and, if correctly developed, will reflect the best obtainable experimental and scientific information. EPA is interested in promoting the use of computerized design techniques in order to achieve better treatment at a minimum cost. (See also W77-09154) (Bell-Cornell)

W77-09208

MATHEMATICAL MODELING OF DUAL WATER SUPPLY SYSTEMS, Weston (Roy F.), Inc., West Chester, Pa. For primary bibliographic entry see Field 6D.

W77-09210

FUTURE DIRECTIONS IN URBAN WATER MODELING, Water Resources Engineers, Inc., Walnut Creek, Calif.

M. B. Sonnen, L. A. Roesner, and R. P. Shubinski. In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 829-832, July 1976. 14 ref.

Descriptors: *Mathematical models, Storm water, Combined sewers, Water distribution (Applied), Waste treatment, Water quality control, Systems analysis, Hydrology, Simulation analysis, *Water resources.

Identifiers: *Urban water systems, Sewer systems, Water use, Receiving waters, Modeling philosophy.

In 1974-75, a review was performed by Water Resources Engineers (WRE) for EPA's Storm and Combined Sewer Section Concerning the state-of-the-art of urban water modeling. Moreover, WRE was then to recommend what model development work could be undertaken most feasibly in the following five years. The scope of the review was to include all the urban water subsystems, such as watersheds, water supplies, treatment, or water use, but the emphasis was placed on storm and combined sewer problems and their modeling. Herin, an outline is presented of the findings with respect to most of the urban water subsystems reviewed. Gaps in needed modeling technology are identified, and philosophical approach to filling those gaps is developed. Finally, a phased implementation program for developing the needed models is suggested. Inadequacies that continue to exist in problem-solving capability are more philosophical and scientific than numerical. (See also W77-09154) (Bell-Cornell)

W77-09213

TO ESTABLISH VIABLE METHODS OF MAINTAINING WASTE TREATMENT FACILITY EFFICIENCIES WITH REFERENCE TO FLOW VARIATIONS, VOLUME II.

MacLaren (James F.) Ltd., Toronto (Ontario).

Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 55, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, 1977. 67 p, 30 fig, 18 tab, 6 ref, 2 append.

Descriptors: *Treatment facilities, *Waste water treatment, *Sewage treatment, *Waste disposal, Flow rates, Flow measurement, Flow system variability, Efficiencies, Average flow, Peaking, Design criteria, Viability, Methodology, Municipal wastes, Fluctuations, *Canada.

Identifiers: *Ontario.

Sewage flow records from eleven individual sewage systems of varying sizes were examined. Daily flow records have been evaluated for all plant to establish variations in average daily flow over periods of one, two, and in some cases three years. Flow records were statistically analyzed to determine the flow rate occurring at the 10 and 25 percent exceedence levels. Typical exceedence flow profiles for two municipal waste treatment plants are presented, along with the mean daily flow, the maximum flow and ten and 25 percent exceedence levels. To establish meaningful design criteria for equalization, extensive analysis of daily and diurnal variations of flow in Ontario sewage treatment plants was carried out. A significant conclusion of the analysis was that the peaking factors are essentially independent of the plant size. The most important criteria for flow equalization appeared to be the maximum daily peaking factor and the diurnal peaking factor. Diurnal peaking factors decreased with increasing peaking periods. On the basis of the findings a new and simplified method is suggested for sizing and operation of equalization basins. Maximum benefit due to equalization can be predicted for the performance of primary clarifiers. A construction cost comparison for plant sizes of 5 and 50 mgd indicates that fully equalized flow can result in a small reduction over variable flow design. Partial

equalization does not appear to be a viable alternative. The cost benefits may be considered to be conservative, yet potential cost benefits may be higher when increased performance of the various units and the elimination of surcharge energy costs at peak loadings are included. (See also W74-08398) (WATDOC)

W77-09214

DESIGN AND PERFORMANCE CRITERIA FOR SETTLING TANKS FOR THE REMOVAL OF PHYSICAL-CHEMICAL FLOCS, VOLUME II, Toronto Univ. (Ontario). Inst. Environmental Sciences and Engineering.

G. W. Heinke, M. A. Qazi, and A. Tay. Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report, No 56, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, 1977. 115 p, 36 fig, 12 tab, 88 ref. 72-5-7.

Descriptors: *Flocculation, *Chemical wastes, *Physical properties, *Design criteria, Performance, Suspended solids, Sediments, *Waste water treatment, Waste treatment, Chemical reactions, Behaviour, Hydrolysis, Laboratory tests, On-site tests, Industrial plants, Influent streams, Effluent streams, *Settling basins, *Canada.

Identifiers: *Settling tanks, *Quiescent conditions, *Variable flow conditions, Toronto, Sarnia, Windsor, Burlington, Ontario.

The objective was the study of settling behavior of physical-chemical suspensions, on both a laboratory and plant basis, in order to suggest design guidelines and methods to predict the performance of settling tanks treating such suspensions. A brief literature review confirmed the belief that relatively little work on this topic had been carried out, although there was much pertinent background material available. Laboratory studies under quiescent settling conditions and plant studies have been carried out during the past three years at Toronto, Sarnia, Windsor and the Wastewater Technology Centre in Burlington. The addition of coagulants (ferric chloride, alum and polymer) to domestic wastewater for the primary purpose of phosphorus removal has an important side effect in increased suspended solids and BOD removal. In addition, this study shows that flow rates can be increased substantially, thus increasing the capacity for existing settling tanks. Tentative guidelines have been suggested for the design of settling tanks. The use of these guidelines will result in smaller settling tanks than would be required by the current guidelines. The cost savings for the expansion of existing plants and the construction of new settling tanks are expected to be significant. (See also W77-0896) (WATDOC)

W77-09215

AEROBIC DIGESTION OF ORGANIC SLUDGES CONTAINING INORGANIC PHOSPHORUS PRECIPITATES, VOLUME II, SLUDGES PRECIPITATED BY LIME ADDITIONS TO RAW SEWAGE,

Toronto Univ. (Ontario). Dept. of Civil Engineering; and Toronto Univ. (Ontario). Inst. for Environmental Studies and Engineering.

J. Gancarczyk, and M. F. D. Hamoda. Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No 58, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, 1977. 81 p, 44 fig, 5 tab, 13 ref. 72-5-4.

Descriptors: *Organic wastes, *Aerobic treatment, *Sludge digestion, *Digestion tanks, Inorganic compounds, Phosphates, *Lime, *Chemical precipitation, Sewage, *Waste water treatment, Industrial plants, Model studies, Chelation, Flocculation, Carbon, Nitrogen, Dewatering, Suspended solids, *Sludge treatment, *Canada, Industrial wastes.

Identifiers: *Batch loading experiments, *Semicontinuous loading experiments, *Toronto (Ontario).

Laboratory experiments were carried out at 20 C in completely mixed digestion units on sludges collected from a municipal wastewater treatment plant in Metropolitan Toronto. Tests were carried out simultaneously on lime-primary sludges (precipitated with Ca (OH)₂) and primary sludges (no chemical addition). Batch digestion experiments and semi-continuous (fed once a day) loading experiments were carried out. Lime-primary sludges from raw sewage precipitated with different lime dosages (140-600 mg/l) were studied at pH values in the range of 9-12. For comparative purposes, all sludges studied had initially a similar volatile solids content. Digester detention time was varied from 7-15 days to investigate the effect of this parameter on aerobic digestion of the sludges. Aerobic periods of at least 15 days at 20 C were required for effective treatment, especially for sludges having an initial pH in the higher range of values. The digestion process kinetics of lime-primary sludges with initial pH in the range of 9-10 were higher than those of the primary sludge (control) but for lime-primary sludges having initial pH in the range of 10-12, the high alkalinity or calcium content of the sludge resulted in lower process kinetics. The nitrification process was inhibited in digesters treating sludges precipitated with high lime dosages. The supernatant of the digested sludges had low soluble organic carbon and nutrient (phosphorus and nitrogen) contents. The aerobically digested lime-primary sludges had excellent dewatering characteristics. (See also W74-07268) (WATDOC)
W77-09216

UPGRADING OF SEWAGE LAGOON EFFLUENTS.

Ontario Ministry of the Environment, Toronto. Pollution Control Branch.
J. W. G. Rupke, and K. Chisholm.
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 54, Environmental Protection Service, Fisheries and Environment Canada, Ottawa, Canada, 1977. 27 p., 11 fig., 4 tab., 74-1-37.

Descriptors: *Sewage lagoons, Effluents, *Effluent streams, *Waste water treatment, *Waste storage, Quality control, Biochemical oxygen demand, Suspended solids, Pollutants, Flocculation, Sedimentation, Filtration, Flow measurement, Systems analysis, Chemical reactions, *Canada, Water quality standards, *Treatment. Identifiers: *Strathroy (Ontario).

Various unit processes were evaluated at the Strathroy, Ontario, lagoon for the purpose of upgrading conventional lagoon effluent quality. Systems to reduce both the suspended matter and also the soluble components were used. Unit processes investigated included physical-chemical treatment followed by filtration, air flotation, microstraining and the rotating biological contactor. It was found that a suitable system for upgrading lagoon effluent quality would involve a rotating biological contactor for ammonia nitrogen and soluble BOD reduction, followed by chemical coagulation-sedimentation and multimedia filtration. (WATDOC)
W77-09218

AN ASSESSMENT OF KRAFT BLEACHERY EFFLUENT TOXICITY REDUCTION USING ACTIVATED SLUDGE.

Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
B. E. Jank, D. W. Bissett, V. W. Cairns, and P. H. M. Guo.
Technology Development Report No. EPS 4-WP-77-3, May, 1977. 109 p., 19 fig., 8 tab., 22 ref., 8 append.

Descriptors: *Pulp and paper industry, *Bleaching wastes, *Effluents, *Influent streams, *Toxicity, *Activated sludge, Waste water treatment, Wastes, Bioassay, Methodology, Testing, Testing

procedures, On-site tests, Analysis, Variability, *Canada, Industrial wastes.
Identifiers: *Two stage system, *Single stage system, Espanola, Ontario.

Bleach plant effluent is considered to be one of the major contributors to toxicity in kraft pulp and paper mill operations. A pilot scale two-stage activated sludge system was operated on the six-stage kraft bleachery effluent at Eddy Forest Productions Limited, Espanola, Ontario, to study the practicability of using a two-stage biological system to meet effluent requirements specified in the Pulp and Paper Effluent Regulations (1971). For comparison purposes a conventionally loaded single-stage activated sludge system was operated in parallel with the two-stage system. Emphasis was placed on an assessment of the capabilities of the activated sludge systems for the reduction of acute toxicity to juvenile rainbow trout. The results showed that the two-stage system was consistently achieving greater toxicity reduction than the single-stage system even at considerably higher volumetric loadings. At similar volumetric loadings the two-stage system also provided greater BOD5 removal than the single-stage system. Treatment efficiency and toxicity reduction were both affected by wood species. Effluents from both activated sludge systems treating kraft bleachery effluent would not meet the toxicity requirements specified in the Pulp and Paper Effluent Regulations (1971). (WATDOC)
W77-09223

LAND APPLICATION OF WASTE WATER, A BIBLIOGRAPHY.

Office of Water Research and Technology, Washington, D. C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 511. Price codes: A18 in paper copy, A01 in microfiche. —Water Resources Scientific Information Center, Report OWRT/WRSC 77-204, June 1977. 408 p.

Descriptors: *Waste water disposal, *Bibliographies, *Waste disposal, *Water reuse, *Waste water treatment, Industrial wastes, Municipal wastes, Recycling, Reclaimed water, Sewage disposal, Sludge disposal, Soil disposal fields, Sprinkler irrigation, Tertiary treatment, Water spreading.
Identifiers: *Land application.

This report, containing 460 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 101,774 abstracts covering SWRA through September 15, 1976 (Volume 9, Number 18). Author and subject indexes are included.
W77-09265

RENOVATION RESPONSE TO APPLICATION FREQUENCIES FOR GRASS FILTRATION TREATMENT OF SEWAGE EFFLUENT.

Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
J. V. Husted.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 512. Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, August 1974. 63 p., 20 tab., 12 fig., 23 ref. OWRT B-054-PA(1), 14-31-0001-3931.

Descriptors: *Overland flow, *Rates of application, *Waste water treatment, *Sewage treatment, Seasonal, Effluents, Nitrates, Phosphates, *Filters, *Filtration.

Identifiers: *Nitrate removal, *Phosphate removal, *Grass filtration systems, *Final treatment, Wastewater systems, Flow distance, Application frequency, Long contact time.

Effects were determined of four application frequencies on wastewater renovation by grass filtration. Frequencies chosen for study were two-, three-, and six-times-per-week, and a continuous-flow application. A hydrologic analysis of the three plots was made through the use of inflow rates, runoff rates, piezometers, and soil profile investigations. Infiltration rate was slightly influenced by application rate and frequency. The reductions of nitrate-N and orthophosphate-P for the two-, three-, and six-time-per-week application frequencies were less than five percent. Continuous-flow treatment gave greater reductions of nitrate-N and orthophosphate-P than the intermittent method. Infiltration rate decreased with a decrease in application rate, but remained nearly constant for the two-, three-, and six-times-per-week application frequencies. Piezometer response indicated that no wastewater appeared as interflow in the surface runoff from the plots. (Sink-Penn State)
W77-09271

AMMONIA TRANSPORT IN WATER SATURATED POLYMERIC FILMS.

Missouri Univ.-Kansas City. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W77-09274

WATER RECLAMATION: TECHNOLOGY AND PUBLIC ACCEPTANCE.

Stone (Ralph) and Co., Inc., Los Angeles, Calif.
R. Stone.
Journal of the Environmental Engineering Division-ASCE, p 581-594, June, 1976. 7 fig., 4 tab., 3 ref.

Descriptors: *Attitudes, *Reclamation, *Water reuse, *Surveys, *Feasibility, Public health, Viruses, Industrial water, Irrigation, Reclaimed water, Waste water treatment, Costs, *California. Identifiers: Southern California.

Public attitude surveys among 10 Southern California communities, industrial plant management, public water resources officials, and water resources management experts were conducted to assess the public acceptance and technological feasibility of water reclamation. Public attitudes were largely accepting the lower contact uses. The public reuse of waste water for higher contact uses, particularly human consumption, encountered more severe constraints in attitude due to the higher treatment costs associated with additional treatment and possible adverse effects on public health resulting from the danger of treatment plant failure. Reuse in industrial cooling and processing appears particularly promising due to its low contact nature and relatively large water use. Reuse of waste water for other nonbody contact purposes, particularly agriculture (irrigation), also appears promising. Existing technology is generally sufficient to provide waste water of acceptable quality for all uses; however, improvements in the detection and removal of viruses are needed. (Kreager-FIRL)
W77-09317

SYSTEM DESIGN OF A TUBULAR REVERSE OSMOSIS PLANT.

California Univ., Los Angeles.
For primary bibliographic entry see Field 5F.
W77-09319

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PREVIEW.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09379

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SUMMARY.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

W77-09380

BINGHAMTON WASTEWATER MANAGEMENT STUDY: BACKGROUND INFORMATION APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09381

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PLAN FORMULATION APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09382

BINGHAMTON WASTEWATER MANAGEMENT STUDY: COMMENTS APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09383

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SPECIALTY APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09384

BINGHAMTON WASTEWATER MANAGEMENT STUDY: DESIGN AND COST APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09385

BINGHAMTON WASTEWATER MANAGEMENT STUDY: IMPACT ASSESSMENT AND EVALUATION APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09386

BINGHAMTON WASTEWATER MANAGEMENT STUDY: INSTITUTIONAL ANALYSIS APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09387

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PUBLIC INVOLVEMENT APPENDIX.

Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09388

DAIRY MANURE CAN BE USED SAFELY,

California Univ., Davis.
For primary bibliographic entry see Field 5G.
W77-09389

WATER MANAGEMENT ASPECTS OF THE AGRICULTURAL UTILIZATION OF LIQUID MANURE AND PRELIMINARY EXPENDITURE STANDARDS, (IN GERMAN),

Institut fuer Wasservirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 5G.
W77-09391

WATER MANAGEMENT PROBLEMS INVOLVED IN THE TREATMENT AND UTILIZATION OF LIQUID MANURE, (IN GERMAN),

Institut fuer Wasservirtschaft, Berlin (East Germany).
D. Kramer.
Wasservirtschaft-Wassertechnik, V 22, No 6, p 182-184, June, 1972. 4 fig, 6 ref.

Descriptors: *Waste water treatment, *Waste disposal, Liquid wastes, *Water pollution, Nitrogen, Phosphorus, Economics, Separation techniques, Activated sludge, Water pollution control, *Pollution abatement, *Farm wastes. Identifiers: Land spreading, *East Germany.

General problems of the treatment and disposal of liquid manure in East Germany are discussed. Liquid manure constitutes a real problem in terms of water pollution due to its high BOD value (4,000 to 7,000 mg per liter), and its high nitrogen and phosphorus contents. While the use of organic fertilizer has been in steady decrease for decades, the application of liquid manure to farmlands represents the best solution in terms of economics and environmental protection. Laboratory tests adopting the activated sludge method for the treatment of liquid manure gave largely satisfactory results in one-stage operation, with no significant improvement in two-stage process. However, dilution of the liquid manure at a ratio of 25 or more, and phase separation with separate treatment of the sludge obtained were necessary. Increasing fish death during the last decade due to agricultural organic effluents has occurred. (Solid Waste Information Retrieval System)
W77-09392

DESIGN PARAMETERS FOR ANIMAL WASTE TREATMENT SYSTEMS - NITROGEN CONTROL.

New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.

T. W. Bateman, R. C. Locher, T. B. S. Prakasam, E. G. Srinath, and T. W. Scott.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 993. Price codes: A08 in paper copy, A01 in microfiche. Environmental Protection Agency Report No. EPA-600/2-76-190, Sept., 1976, 144 p., 37 fig., 27 tab., 29 ref.

Descriptors: *Design, *Waste treatment, Feasibility studies, Liquid wastes, *Oxidation lagoons, Crop response, Water pollution, Groundwater, Agricultural runoff, Grasses, Corn(Field), Aeration, *Farm wastes, Nitrogen, Rates of application. Identifiers: Odor control, *Nitrogen control, Land application, Poultry manure.

The objectives were to: (a) develop design criteria for nitrogen and odor control in animal waste stabilization systems; (b) demonstrate the feasibility of nitrogen control using the oxidation ditch; (c) determine the rate, form, and time of manure application permissible without causing surface or groundwater pollution; and (d) determine the optimum rate, form, and time of application for best crop response. Laboratory, pilot plant, and full scale studies were conducted to develop design parameters for odor and nitrogen control. Information concerning the fate of manure nitrogen and crop response was derived from agronomic field studies. A method of determining oxygen requirements for stabilization based on exerted carbonaceous and nitrogenous oxygen demand was developed. Controlled nitrogen removal in the range of 30 to 90 percent was developed. Controlled nitrogen removal in the range of 30 to 90 percent was demonstrated. Nitrogen losses were due to ammonia volatilization and/or nitrification-denitrification. Field studies indicated no differences between raw and aerobically stabilized poultry manure in nutrient availability to plants or surface runoff losses. At a given rate of manure application, soil nitrate levels were higher under corn in comparison to grasses. The maximum recommended application rate of poultry manure for corn was 224 kg N/ha. Application rates for grasses were limited to 100-170 kg N/ha by plant response. (East Central)
W77-09393

DESIGN CRITERIA FOR SWINE WASTE TREATMENT SYSTEMS,

North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering. F. J. Humenik, and M. R. Overcash.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 032. Price codes: A08 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-76-233, Oct., 1976. 292 p., 89 fig., 57 tab., 94 ref.

Descriptors: *Farm wastes, *Waste treatment, *Hogs, *Design criteria, Lagoons, Waste treatment, Liquid wastes, Aeration, Model studies, Odor, Nitrogen, Irrigation.

Coordinated laboratory, field pilot-, and farm-scale lagoon studies were conducted to define relationships between loading intensity and frequency based on treatment performance, sludge accumulation, and odor potential. Surface aeration of field pilot units and farm-scale lagoons was also investigated to evaluate aeration levels required for odor control and the effect of surface aeration on nitrogen and organic transformations. Laboratory studies were designed to elucidate basic chemical, physical, and biological mechanisms important in explaining and modeling lagoon performance. Long-term mass balance studies were conducted to define the fate of waste input and thus total constituent loss from the system. Predictive and interpretive relationships for lagoons based on constant batch loading and continuous loading were derived to describe the supernatant concentration of un-aerated lagoons. Methods for determining steady-state concentrations and first-order reaction rate constants for oxygen demand, organic carbon, and nitrogen were developed and compared with laboratory and field pilot-scale data. Lagoon liquid from a farm-scale unit was irrigated to nine 9.24 m x 9.24 m Coastal Plain soil-Bermuda grass plots at nitrogen loading rates of 300, 600, and 1,200 kg N/ha./year. Mass balance data were collected to determine the fate of applied waste constituents. (East Central)
W77-09394

CONVERSION OF CATTLE MANURE INTO USEFUL PRODUCTS,

California Univ., Los Angeles. School of Engineering and Applied Science.

B. S. Dunn, J. D. Mackenzie, and E. Tseng.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-239 668. Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-76-238, Sept., 1976, 33 p., 7 fig., 7 tab., 5 ref.

Descriptors: *Farm wastes, *Waste treatment, *Cattle, *Byproducts, *Pyrolysis, Design, *Recycling, Rubber, Oil, Fertilizers, Paint.

The purpose was to design and build a pyrolysis apparatus for cattle manure and to investigate the potential uses of the pyrolysis by-products. A pyrolysis machine of semi-continuous feed capabilities was designed and built. Various conditions of pyrolysis treatments were investigated and their influence on the amount and composition of the by-products determined. High carbon residues were found to require lower pyrolysis temperatures. The carbons content of these residues appeared to be unaffected by the geographic location of the original manure. Contact with interested parties and appropriate industries who could be prospective users of each of the products was initiated to obtain their technical expertise in evaluating these products. The pyrolysis by-products seem to have some potential industrial applications. These by-products include the solid residue, an oil fraction, and an aqueous fraction. The solid residue may serve as a carbon black substitute or as a filler material in rubber, ink, and paint. The aqueous fraction collected during pyrolysis has been evaluated for fertilizer applications. (East Central)
W77-09395

MANURE HARVESTING PRACTICES: EFFECTS ON WASTE CHARACTERISTICS AND RUNOFF.

Colorado State Univ., Fort Collins.
R. W. Hansen, J. M. Harper, M. L. Stone, G. M. Ward, and R. A. Kidd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-238 476, Price codes: A12 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-76-292, Dec., 1976, 104 p. 10 fig., 21 tab., 80 ref.

Descriptors: *Farm wastes, *Management, Pollution abatement, Feed lots, *Agricultural runoff, Chemical properties, Physical properties, Biological properties, Ash, *Waste treatment, Fertilizers.

To develop a basis for better manure harvesting management practices, a combined field and laboratory study was conducted. The effect of management practices on manure qualities and runoff pollution potential were compared on 3 feedlot pens with fully surfaced, partially surfaced, and unsurfaced conditions. Average N, P and K elements were present in a ratio of approximately 4:1:2 providing 46 lbs. N, 11 lbs. P and 27 lbs. K per ton of dry manure. For recycling purposes ash is an important fraction of manure and can be reduced by use of hard surfaced pens. Ash content averaged 36.2%. Fiber and lignin in manure are directly related to the fiber content of the ration. The effect of decomposition of the manure was greatest on its viscosity and squeeziability. Bulk density and particle size remained the same. Surfaced feedlot areas have a larger percentage of precipitation in runoff with higher concentrations of pollutants. Increased animal densities on surfaced pens will offset the difference with non-surfaced pens and can result in a lower per-animal pollution potential from runoff.
W77-09396

DESIGN PARAMETERS FOR THE LAND APPLICATION OF DAIRY MANURE.

Cornell Univ. Agricultural Experiment Station, Ithaca, N. Y. Dept. of Agronomy.
S. D. Klausner, P. J. Zwerman, and D. R. Coote.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 282, Price codes: A12 in paper copy, A01 in microfiche. Environmental Protection Agency Report EPA-600/2-76-187, Oct., 1976, 248 p. 77 fig., 55 tab., 225 ref.

Descriptors: *Farm wastes, *Dairy industry, *Waste treatment, *Waste disposal, *Design, *Agricultural runoff, *Snowmelt, *Application rates, Nitrogen, Sediments, Tile effluent, Phosphorus, Crop response, Computer models, Economics, Surface drainage, Subsurface drainage, Legislation.

The effects of climate, application rates of dairy manure, timing of application and soil management practice were studied in relation to discharge of nitrogen and phosphorus via surface runoff, sediment and tile effluent. Losses of nutrients from the land were influenced by the rate and timing of manure application in addition to the type of climatological event causing runoff. The greatest discharge of nutrients resulted from applying manure on actively melting snow. Modest rates of application made in the winter during non-snowmelt periods resulted in minimal losses. Concentrations of nitrogen in surface runoff as measured over time, were lower than those found in tile effluent. The reverse was true for soluble phosphorus. The yield response of corn increased while efficiencies of nitrogen utilization decreased at the higher rates of application. A computer model dealing with the economic impact of control legislation was developed. Modeling approaches to farm scale environmental problems are feasible if assumptions and simplifications do not influence the results too greatly, or in ways which are unpredictable. (East Central)
W77-09397

LIVESTOCK AND THE ENVIRONMENT, A BIBLIOGRAPHY WITH ABSTRACTS—VOLUME III.

East Central Oklahoma State Univ., Ada. School of Environmental Science.
M. L. Rowe, and Linda Merryman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 942, Price codes: A14 in paper copy, A01 in microfiche. Report EPA-600/2-76-189, July 1976, 310 p. EPA 1HB617, R-801454-03.

Descriptors: *Farm wastes, *Waste treatment, Waste disposal, *Livestock, *Bibliographies, *Feed lots, Abstracts, Environment.

Management and research information on animal wastes has expanded rapidly in recent years. This material has appeared in such diverse sources as journal articles, conference papers, university publications, government publications, magazine articles, books or book chapters, and theses. This bibliography of 1,200 references was compiled in order to speed the flow of information on findings in one segment compiled in order to speed the flow of information on findings in one segment of the livestock industry to other segments that could benefit from this technology. Included are the following indexes: (1) author, (2) keyword, (3) animal information categories. These indexes are followed by a section of abstracts of each reference entry found in the bibliography. Single copies of most articles can be obtained in hard copy or microfiche form at cost from the Animal Waste Technical Information Center, School of Environmental Science, East Central Oklahoma State University, Ada, Oklahoma 74820. (East Central)
W77-09398

ANIMAL WASTE MANAGEMENT IN THE NORTHERN GREAT PLAINS.

South Dakota State Univ., Brookings. Water Resources Research Inst.
M. L. Horton, J. L. Wiersma, and J. L. Halbeisen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 963, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Report No. EPA-600/2-76-188, September, 1976, 83 p., 7 fig., 45 tab., 26 ref.

Descriptors: *Salinity, *Salts, *Cattle, *Feed lots, *Crop response, Performance, *Nutrients, *Cations, *Sodium, *Great Plains, *Farm wastes, Crop production, Management, Rates of application, Waste disposal, Waste treatment.
Identifiers: *Northern Great Plains, *Land application.

The effect of salt level of the ration for beef steers upon salinity of the waste and the effects of the applied waste upon the soil and upon crop production were investigated. In addition, the study was conducted in both covered and open feedlot pens to determine the effect of shelter in a northern climate upon animal performance and waste characteristics. The field portion of the study included 4 rates of waste up to 179 MT/ha. applied to plots 0.02 ha. in size. Detailed soil analyses were made which included salinity, nutrients, cations, and the dispersion hazard as indicated by the level of exchangeable sodium. The levels of salt used in the ration appeared to have little or no effect on animal performance; however, the salinity and sodium levels of the waste were directly affected. The salinity level of the surface 30 cm of soil where high rates of waste were applied was sufficiently high to affect the growth of corn. The lack of leaching water caused a maximum effect of the applied waste in the surface layer. (East Central)
W77-09399

CONVERSION OF CATTLE FEEDLOT WASTES TO AMMONIA SYNTHESIS GAS.

Texas Tech Univ. Lubbock. Dept. of Chemical Engineering.

J. E. Halligan, K. L. Herzog, H. W. Parker, and R. M. Sweazy.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-239 668, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Report No. EPA-600/2-74-090, December, 1974, 46 p., 7 fig., 5 tab., 38 ref. R 801065.

Descriptors: *Cattle, *Feed lots, Gases, Equipment, *Farm wastes, *Ammonia, *Waste treatment, Waste disposal.

Identifiers: *Fluidized bed reactor, Anhydrous ammonia, *Synthesis gas.

A study was undertaken to determine the potential of a process to convert cattle feedlot manure to anhydrous ammonia. Due to the fact that ammonia is currently produced on a large scale using natural gas and air, only the processing associated with a reactor system to convert the manure in a suitable synthesis gas was considered in this study. The synthesis gas was considered in this study. The synthesis gas can be further processed to anhydrous ammonia using existing technology. (East Central)
W77-09401

SURVIVAL OF PATHOGENS IN ANIMAL MANURE DISPOSAL.

Minnesota Univ., St. Paul. Coll. of Veterinary Medicine.
For primary bibliographic entry see Field 5B.
W77-09402

CHEMICAL COAGULATION OF FEEDLOT RUNOFF.

R. J. Smaus.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 765, Price code: A04 in paper copy, A01 in microfiche. MS Thesis, May 1972, 60 p., 25 fig., 7 tab., 23 ref. OWR T-A-022-NEB(3).

Descriptors: *Feed lots, *Agricultural runoff, Chemicals, *Coagulation, *Costs, Turbidity, Sludge, *Waste water treatment, Waste treatment, Farm wastes.
Identifiers: *Color reduction.

Treatment of feedlot runoff by chemical coagulation was evaluated, with color reduction as the prime goal. The removal of organic material and other desirable effects were also anticipated. Alkalinity was important in the chemical coagulation process. Turbidity and apparent color can be reduced by the application of moderate amounts of coagulants, whereas the colloidal color, believed to be hydrophilic, requires large coagulant dosages for significant removal. The reduction of the total solids, suspended solids, and COD may be related to the reduction of turbidity. Feedlot runoff can be clarified by coagulation using the common metallic coagulants. Estimated chemical costs of such treatment are in excess of \$1.00 per 1000 gallons. From the chemical costs involved and the large volume of chemical sludge produced, chemical coagulation does not appear to be a practical method of treatment this waste. (Cartmell-East Central)
W77-09404

ACTIVATED CARBONS FOR EFFLUENT AND WATER TREATMENT.

J. S. Batchelor.
Effluent and Water Treatment Journal, Vol 17, No 4, p 175, 177, 179, 181, April, 1977.

Descriptors: *Activated carbon, *Effluents, *Waste water treatment, *Industrial wastes, Chemical wastes, *Recycling, Water quality, Water purification, Waste water treatment, Storage, Filtration, Byproducts.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

The production and use of activated carbon for industrial waste effluent treatment were reviewed. Anthracite activation in a steam fluidized bed which was directly heated by submerged gas burners provided the means for commercial production of a high quality activated carbon. Activated carbon is available in a range of adsorptive capacities for various applications as a powdered or granular form. Primary treatment applications included removal of toxic, organic, or inorganic compounds from the effluents of chlorine, sodium hydroxide, and pesticides manufacturing. The concentration of these compounds can be reduced by 99% with activated carbon. The effluent can then undergo activated sludge treatment. Secondary treatment is usually more economical because less polluted effluents reduce the load on the activated carbon and extend the time between reactivations. Recovery of valuable substances from effluents enhances the economics of secondary treatment. This treatment level may be used for the recovery of acetic acid from rubber thread factory effluent, and for the removal of detergents from car wash waters. Moreover, industrial water can be recycled by using activated carbon treatment. Reactivating the carbon reduces the original amount of carbon by 10%. Economic comparisons were made for powdered and granular activated carbon. Granular carbon costs are 500% that of powdered carbon and its use requires some additional capital outlay. High-rate backwashing was an adequate treatment for the problem of bacterial growth on granular carbon beds. (Collins-FIRL) W77-09409

TREATING WASTE WATER FROM BECKMAN PREP. OF LACTAM-BY TWO STAGE CONC. EXTN. OF RESIDUAL LACTAM, RESIDUE COMBUSTION, SULFUR DIOXIDE RECOVERY AND CONVERSION TO SULFURIC ACID FOR RECYCLING.
French Patent FR 2315-502. Issued February 25, 1977. Derwent French Patents Abstracts, Vol Y, No 14, p E2, May, 1977.

Descriptors: *Patents, *Chemical wastes, *Distillation, *Industrial wastes, *Plastics, *Recycling, Chemical industry, Chemical reactions, *Waste water treatment, Water purification, *Organic wastes.
Identifiers: *Beckmann conversion, Sulfur dioxide, Caprolactam, Cyclohexanoneoxime, Lactam.

A patent was issued for a treatment of waste water from the Beckmann conversion of lactam. Waste water is concentrated by a two-step distillation to 70-15% water. Lactam is recovered from an extracted aromatic hydrocarbon. The extract residue is subjected to oxidative combustion and SO₂ is converted to form H₂SO₄. Organic solvents are recovered and the H₂SO₄ can be reused. Lactam and organic solvent recoveries are high. The process is highly useful in the preparation of caprolactam from cyclohexanoneoxime. (Collins-FIRL) W77-09410

SOME CONSIDERATIONS ON THE RECOVERY AND DISPOSAL OF PHOTOLAB WASTE,
C. T. Davies.
The BKSTS Journal, p 54-56, 58-60, 67, March, 1977. 1 fig, 5 tab, 4 ref.

Descriptors: *Chemical wastes, *Electrolysis, *Ion exchange, *Resins, Metals, Chemical reactions, Separation techniques, *Recycling, Sludge, Hydrogen ion concentration, Microorganisms, Waste treatment, *Waste water treatment.
Identifiers: *Photographic wastes, Silver, Sulfuric acid, Sodium sulfate.

The relationship of photographic wastes and British effluent control was considered. Effluent oxygen demand, pH, and metallic ion content were used as parameters of effluent quality. Reac-

tion products of metals in photographic waste effluents were explored. Their effects included toxicity to sewage treatment microorganisms and the restriction of sludge as fertilizer because of its metallic ion content. Treatment of bleach baths must avoid the discharge of oxidizing ferricyanide or dichromate radicals into sewage systems. The control of pH was no problem. Chemical reactions produce a neutralization that creates a suitable pH. The expense of photographic processing chemicals was a prime inducement for the development of recovery systems. Silver recovery and fix solution re-use were investigated. The most efficient silver recovery system was based on electrolytic treatment. A high-grade silver was recovered from a continuous circulation system. Developer recovery must include bromide removal. An ion exchange method was developed, but resin regeneration using sulfuric acid presented handling and treatment problems. A substitute method using sodium sulfate was found. Another successful method employed sodium bicarbonate, sodium chloride, and sodium sulfate. Treatment systems which were developed to reduce effluent discharge included one employing Phenidone, and another employing water hyacinths. Water hyacinths were capable of absorbing gold, silver, cobalt, strontium, cadmium, nickel, lead, and mercury. (Collins-FIRL) W77-09411

MEMBRANE ULTRAFILTRATION FOR TREATMENT AND WATER REUSE OF TNT-MANUFACTURING WASTES,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
D. Bhattacharyya, K. A. Garrison, and R. B. Grieves.
Journal Water Pollution Control Federation, Vol 49, No 5, p 800-808, May, 1977. 9 fig, 17 ref. DADA 17-72-C-5050.

Descriptors: *Membrane processes, *Chemical wastes, *Water reuse, Chemical industry, Organic compounds, Separation techniques, *Filtration, Polyelectrolytes, Hydrogen ion concentration, Chemical properties, Waste treatment, Model studies, Design criteria, Water purification, *Waste water treatment.
Identifiers: *TNT wastes, Nitrotoluenes, *Ultrafiltration(Membranes).

Membrane ultrafiltration was used to treat TNT waste water for in-plant reuse. The 'pink water' treated was the product of partially-purified TNT washing after selite treatment. Organic compounds in this water were alpha-TNT, dinitrotoluenes, and trace nitrotoluenes. Continuous flow ultrafiltration experiments were conducted to investigate four membranes. These were PSAL (Millipore), UM-05 (Amicon), PM-10 (Amicon), and F-601 (Gulf). Results showed that rejection of organic molecules was strongly pH-dependent. PM-10 showed very poor rejection even at pH 11.0. F-601 had a cellulosic composition. These factors eliminated them from pH variation studies. PSAL and UM-05 showed abrupt rejection improvements at pH 9.5 and above. PSAL was selected as the optimum membrane due to its consistently better performance. An average rejection of 0.88 was obtained at pH 11.0. PSAL also rejected inorganic ions, such as sulfate ions, because of its negative charge. This made possible the control of inorganic dissolved solids during water reuse. A computer simulation was used to develop a process design for a treatment and water reuse system for nitrotoluene production. Results of this design process indicated that a tapered module system would be optimum. This system had limited concentrate recycle requirements and produced the highest solute rejection at high water recoveries. Another model was used to determine possible dissolved solids build-up in recycle water at various numbers of passes. It was found that H₂SO₄ could adjust ultrafiltrate pH from 11.0 to 7.5 to eliminate Na₂SO₄ build-up. A membrane area of 192 square meters was suggested for treat-

ing a 52,000 gallon/day flow of pink water with a 40 mg/liter organic carbon content. This would follow a pH adjustment to 11.0. Average ultrafiltrate flux would be 24 gallons/square foot/day. A 10% fresh make-up water content would create a maximum organic carbon concentration of 8.0 mg/liter. Operating costs would be about \$0.49 per cubic meter of product water. (Collins-FIRL) W77-09412

TREATING DISTILLERY EFFLUENT BY RECOVERING TARTAR AND ORGANIC MATTER—WITHOUT INCREASING THE VOL. OF EFFLUENT DURING PURIFICATION.
French Patent FR 2311-757. Issued January 21, 1977. Derwent French Patents Abstracts, Vol Y, No 11, p D3, April, 1977.

Descriptors: *Patents, *Industrial wastes, *Crystallization, *Flocculation, *Hydrodynamics, Effluents, Organic matter, Recycling, Water purification, *Waste water treatment.
Identifiers: Tartar, *Distillery wastes recovery.

A patent was issued for a process to recover tartar and organic matter during purification of wash water from wine lees. The wash water is first mixed with calcium sulfate and sodium carbonate for tartar crystallization. This is followed by the hydrodynamic recovery of tartar. Organics recovery by flocculation and skimming constitute the third stage of the process. Treated effluent is discharged by overflow from the flocculation tank. The process maintains a treated effluent discharge that does not exceed influent volume. Final effluent volume is reduced by up to 66% of that produced by previous processes. Process simplification has also reduced costs. (Collins-FIRL) W77-09414

A THERMAL CONTROLLER FOR THE SHORT COD DETERMINATION,
Agricultural Research and Education Center, Lake Alfred, Fla.
For primary bibliographic entry see Field 5A. W77-09415

ANAEROBIC DIGESTION OF RUM STILLAGE,
National Research Council of Canada, (Ontario). Div. of Biological Sciences.
L. A. Roth, and C. P. Lentz.
Canadian Institute of Food Science and Technology Journal, Vol 10, No 2, p 105-108, April, 1977. 3 fig, 1 tab, 14 ref.

Descriptors: *Anaerobic digestion, *Industrial wastes, *Foods, Chemical oxygen demand, Loads(Forces), Operations, Performance, Yeasts, Temperature, Salts, Inorganic compounds, *Waste water treatment.
Identifiers: Molasses stillage, Rum production.

A 14-month study was conducted to explore anaerobic contact digestion of molasses stillage from rum production. Start up procedures and loading rates were investigated. Digesters were filled with sewage treatment plant effluent containing 0.5% solids. Stillage loads were gradually increased from 0.05 to 0.15 pounds of volatile solids/cu ft/day over a period of 2 to 3 weeks. The liquid retention time was 55 days. Digester temperature was maintained at 35 plus or minus 1 C. The higher loading rate was used as the control. Results showed that rum stillage could be successfully treated by anaerobic digestion, if supplemented with ammonium and phosphate salts. Loading rates up to 0.2 pounds of volatile solids/cu ft/day resulted in reliable digester operation. Higher loading rates of up to 0.5 pounds/cu ft/day would require the addition of 1.5 grams of yeast extract/liter of stillage. An operation efficiency of 77 to 83% was obtained at rates above 0.15 pounds/cu ft/day, with or without yeast extract fortification. The effluent with a strength of 9-13,000 ppm COD required additional treatment before discharge into waterways. (Collins-FIRL)

W77-09416

'NOT ONE DROP OF EFFLUENT'—HYDROCHLORIC ACID RECOVERY FROM SPENT PICKLE LIQUOR.
CHEMSA, Vol 3, No 2, p 20-22, February, 1977.

Descriptors: *Metals, *Industrial wastes, *Acids, *Recycling, Gases, Separation techniques, Zinc, Chemical reactions, Chlorides, Pollution abatement, Waste treatment, *Waste water treatment. Identifiers: Hydrochloric acid recovery, Pickling liquors, Spray roaster process, Metsep process.

A method was developed for regenerating hydrochloric acid from spent pickling waste. A South African facility was built to treat ferrous chloride liquors from several plants in the Vaal area. Nearly 50% of waste liquors contained up to 100 grams/liter of zinc chloride. This resulted from the use of waste liquor in jig stripping. The presence of zinc chloride prohibited treatment by the conventional spray roaster technique. A pretreatment ion-exchange process (Metsep) was used, along with solvent extraction. Zinc chloride separation produced a dilute hydrochloric acid solution used to adsorb hydrogen chloride gas from the spray roaster process. No effluent was produced, but the system proved too expensive. Fresh hydrochloric acid was then used for jig stripping to allow spent liquor treatment by the conventional spray roaster process. The liquor was passed through settlers and filtered before entering the spray roaster. Recovery consisted of contacting spent liquor with hot combustion gases reaching 800 C. The liquor entered the reactor through spray nozzles. The water and hydrochloric acid in the drops were separated and the drops were reduced to ferrous chloride. This product was converted to solid iron oxide and gaseous hydrogen chloride. A cyclone separator removed most of the 10% of the oxide that escaped with the gases. The remaining oxide dropped to the reactor bottom. An absorber removed hydrogen chloride from the reactor gases by absorption of hydrogen chloride in the raffinate. The concentration of acid leaving the absorber was 16-18%. The plant produced no effluent. A collection system for purified storm water provides water for the absorber. About 70% of the customers' hydrochloric acid needs are met by this process. (Collins-FIRL) W77-09417

PRACTICAL APPLICATION OF MEMBRANE TECHNIQUES OF WASTE OIL TREATMENT,
Timken Co., Canton, Ohio.

H. R. Hockenberry, and J. E. Lieser. Lubrication Engineering, Vol 33, No 5, p 247-251, May, 1977. 2 fig, 3 tab, 4 ref.

Descriptors: *Oil wastes, *Membrane processes, *Filtration, *Reverse osmosis, Membranes, Chemical treatment, Industrial wastes, Pilot plants, Separation techniques, *Waste water treatment. Identifiers: *Ultrafiltration, *Refinery wastes.

Pilot studies investigated treatment of oily waste water with ultrafiltration and reverse osmosis. Modified acetate and similar compounds were used as ultrafiltration membranes. Reverse osmosis membranes were made of organic materials treated to become semipermeable. Both test systems had tubular membrane construction. The basic theory of both processes was presented. Test results indicated a difference in the mechanics of demulsification. Ultrafiltration removed surfactants from wastes in the water phase. This resulted in demulsification. Demulsification, in reverse osmosis, seemed to be due to high salt levels in the concentrate tank. Wastes were diluted until oil levels were 40-50% and volumes were 4-10% of initial volume. The water flux rate was too low for efficient operation at this level. Oily waste was transferred to a holding tank where it separated into three phases. Heating to 40-50C speeded the

separation. The differences between membrane and chemically treated wastes were noted in the 'cuff layer' between the oil and water phases. The cuff was well-defined and contained only dirt and grinding debris during membrane treatment. This debris could be filtered out for the water to be recycled for retreatment. The resultant oil from membrane treatment was very clean. Similar results were achieved with repeated chemical treatments. Reverse osmosis produced water with a significantly lower mineral content. The total extractables were higher in ultrafiltration water and were identified as surfactants. The water could be recycled on a limited basis within the plant or disposed of in sanitary sewer systems. (Collins-FIRL) W77-09418

ALTERNATIVE METHODS OF PHENOL WASTEWATER CONTROL,

Envirex Inc., Waukesha, Wis. W. M. Throop. Journal of Hazardous Materials, Vol 1, No 4, p 319-329, March, 1977. 4 fig, 3 tab, 6 ref.

Descriptors: *Phenols, *Oil wastes, *Water pollution control, *Oxidation, Pollution abatement, Biological treatment, Activated carbon, Chlorination, Ozonation, Adsorption, Activated sludge, Filters, Hydrogen ion concentration, Costs, *Waste water treatment. Identifiers: Hydrogen peroxide, Potassium permanganate.

Phenol removal from waste water by chemical and biological oxidation and ozonation was investigated. Biological oxidation of phenols has been successful with trickling filters, activated sludge, and aerated lagoons. Phenol loads above 500 mg/liter decrease system performance significantly. Inconsistent effluent phenol concentrations greatly reduce the suitability of biological treatment for phenol removal. Effective chlorine treatment required careful pH control and the maintenance of residual chlorine to prevent chlorophenol production. Phenol removal by activated carbon was the most effective and most expensive method. Chemical oxidation by hydrogen peroxide or potassium permanganate was successful. Both systems presented process or cost disadvantages, but were reasonable choices for treatment of smaller flows. The best treatment for large flows was ozonation. The treatment was preceded by suspended solids removal by an anionic polyelectrolyte. Complete phenol oxidation by ozone required a 50:1 ozone to phenol ratio. (Collins-FIRL) W77-09419

REFINERY EFFLUENT IMPROVED BY GRAVITY-PRESSURE DEWATERING,
Ecodyne Corp., Union, N.J.

C. B. Grimes. Oil and Gas Journal, Vol. 75, No. 17, p 106-108, April, 1977. 2 fig, 3 tab.

Descriptors: *Dewatering, *Oil wastes, Oil industry, *Industrial wastes, *Waste disposal, Incineration, Landfills, Polyelectrolytes, Biological treatment, Sludge, Flotation, Evaluation, Filtration, Waste water treatment, Equipment, Costs, Performance. Identifiers: *Gravity-pressure dewatering.

Refinery effluent improvement was evaluated. Various treatment processes may be compared by using the disposal-back method to determine end-product properties and disposal methods. Incineration and landfilling were investigated as disposal options. Treatment processes required for disposal by incineration incurred costs which were often prohibitive when compared to processes ending with landfilling. Gravity-pressure dewatering was investigated as an effluent treatment before landfill disposal. The two-step process dewatered sludge conditioned by synthetic high-

molecular-weight polyelectrolytes. The sludge was gravity-filtered by a horizontal screen and filtrate was recycled to the process. An endless, variable-speed screen fed three sets of compression rollers in the pressure stage. The pressure was progressively increased and final dewatered sludge was disposed. Two such systems were described. In the first, oil was removed by gravity and followed by a dissolved air flotation treatment. The effluent was combined with that of another system - chemical precipitation followed by biological treatment. The combined waste sludge was 50% dissolved air flotation float, 30% biological wastes, 0.5% API separator bottoms, and 15% sludge from chemical precipitation. The other system produced sludges of API bottoms, dissolved air flotation float, aerobically digested waste activated sludge, and lime sludge. Other systems may require 10-15 times the horsepower of gravity-pressure systems and have capital costs that are 150-200% greater. (Collins-FIRL) W77-09420

NEW TRENDS IN SOUR WATER STRIPPING,
Shell Canada Ltd., Toronto (Ontario).

P. T. Budzik. Chemistry in Canada, Vol. 29, No. 3, p 24-27, March, 1977. 6 fig, 1 tab, 6 ref.

Descriptors: *Oil wastes, *Ammonia, *Sulfides, *Chemical reactions, *Separation techniques, Oil industry, Industrial wastes, Gases, Pollution abatement, *Waste water treatment, *Canada. Identifiers: *Sour water stripping.

The treatment of petroleum refinery effluents in Canada was studied. The waste water may contain up to 25% sour water. Sour water is composed of sulfides, ammonia, carbon dioxide, mercaptans, phenols, cyanides, organic and inorganic acids, and free and dissolved oils. Hydrogen sulfide and ammonia are of the greatest concern because of Canadian restrictions on sulfides and ammonia in waste water. Effluents must also pass an acute fish toxicity test. Hydrogen sulfide is stripped for odor control. The stripping process is complicated by complex H₂S-NH₃ interactions with other chemicals. Carbonate and sulfite deposits and corrosion present other difficulties. Sour water stripper columns are based on the vapor liquid equilibrium of hydrogen sulfide and ammonia. These elements are present in sour water as ammonium bisulfide that undergoes hydrolysis to form free ammonia and free hydrogen sulfide. They are removed and transferred to vapor stage by lowering their partial pressure with steam or another inert medium. Acid components that can chemically fix the ammonia must be neutralized. Caustic may be added in stoichiometric proportions to combat corrosion. Successful stripper design is dependent upon the collection system; a column that minimizes stripping team and maximizes H₂S and NH₃ removal; and disposal of overhead gases. Older designs used a packed tray or column with optional acidification to aid sulfide removals. Overhead gases were incinerated. Ammonia concentration in stripper bottoms steam is presently the most critical operation factor. Canadian guidelines require bottom concentrations of 50 mg/liter or less of ammonia. This would require a stripping efficiency of 99.5%. This also would provide 99.9 hydrogen sulfide removal and 30-40% phenol reductions. A Claus sulfur plant has been used to treat off-gases to fulfill SO₂ air pollution regulations. (Collins-FIRL) W77-09421

CONTINUOUS PURIFICATION OF PETROLEUM REFINERY EFFLUENTS-BY BIOLOGICAL OXIDATION AND AERATION BETWEEN STAGES,

French Patent FR 2313-322. Issued February 4, 1977. Derwent French Patents Abstracts, Vol. Y, No. 12, p D6, May, 1977.

Descriptors: *Patents, *Oil wastes, *Biological treatment, *Aeration, *Activated sludge,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Hydrogen ion concentration, *Oxidation, Coagulation, Tertiary treatment, Filtration, Sedimentation, Industrial wastes, Effluents, *Waste water treatment.

A patent was issued for a four-stage activated sludge treatment of petroleum refinery wastes. There is a sedimentation phase in which significant amounts of oil and solids are removed. This is followed by stage two: equalization, pH adjustment, coagulation, oxidation, and filtration. The biological treatment section consists of aeration between the stages, biological oxidation, clarification, thickening, and aerobic digestion. The final stage employs tertiary treatment by coagulation/flocculation, filtration, and adsorption on activated carbon. The final effluent contains at least 5 ppm of dissolved oxygen to maintain the quality of the receiving waters. An equalization tank temperature of 32.2-37.8 °C improves biological degradation. (Collins-FIRL)
W77-09422

REMOVING HEAVY METALS IN TEXTILE WASTE.
Permut Co., Paramus, N.J.
H. N. Feigenbaum.
Industrial Wastes, Vol. 23, No. 2, p 32-34, March/April, 1977. 2 fig, 3 tab, 2 ref.

Descriptors: *Heavy metals, *Alkalis(Bases), *Sulfides, *Textiles, *Separation techniques, Industrial wastes, Chemical reactions, Hydrogen ion concentration, Sludge, Dewatering, Filters, Economics, *Waste water treatment.
Identifiers: Sulfex process, Hydroxide precipitation, Cyanides.

The removal of heavy metals from textile effluents was discussed. Heavy metals can be treated by using alkali to adjust pH for precipitation of insoluble metal hydroxides. This was called the 'lime and settle' method. Metals were removed from solution as sulfide precipitates by the Sulfex process. This involved the combination of heavy metal cations with sulfide anions. The process had several advantages over hydroxide precipitation. Effluent residues were lower. The process could overcome complexing or chelating agents that inhibited metal removal by the hydroxide method. Sulfide precipitation at pH 8-9 eliminated alkali and acid addition. A sludge blanket of excess sulfide was maintained that accommodated fluctuations of influent metal concentrations. The use of insoluble materials avoided the problems of chemical feeding of a soluble sulfide source. The equipment used was very similar to that of hydroxide precipitation. Wastes containing cyanide must be pretreated with either method. A batch process was used at flow rates below 10,000 gpd. This eliminated the benefits of the sludge blanket of continuous operation. The resultant sludge contained iron hydroxide, chrome hydroxide, and metallic sulfides. Its characteristics were similar to hydroxide sludge, but it had a greater density. Effective dewatering was accomplished by using centrifuges, vacuum filters, filter presses, or gravity filters. The quantity of sludge was directly dependent upon the ppd of heavy metals and settleable matter in the waste influent, as well as the amount of iron sulfide present. Use of either system should be evaluated on an individual economic basis. Sulfex may be advantageous for chromate wastes and hydroxide could be best for non-chromate wastes. (Collins-FIRL)
W77-09423

RECOVERING POLYVINYL ALCOHOL FROM WASTE WATER—BY COAGULATING WITH BORATE AND INORG. SALT IN PRESENCE OF QUAT. AMMONIUM CPD TO REDUCE WATER CONTENT OF GEL.
French Patent FR 2313-404. Issued February 4, 1977. French Patents Abstracts, Vol. Y, No. 12, p D7, May, 1977.

Descriptors: *Patents, *Coagulation, Water purification, Recycling, Textiles, *Industrial wastes, Chemical oxygen demand, Inorganic compounds, Separation techniques, *Waste water treatment, *Alcohols, Organic compounds, *Gels.

A patent was issued for a process to recover polyvinyl alcohol from waste water by coagulation. This is achieved by adding boric acid or a borate, an inorganic salt, and a cationically active quaternary ammonium base or its salt to the aqueous solution. This is followed by an adjustment to a pH of 8-10 to induce coagulation as a gel. The process also reduces COD in the waste water. The process has been used to treat waste waters of the textile industry. (Collins-FIRL)
W77-09424

TREATMENT OF WOOL-SCOURING EFFLUENTS WITH INORGANIC CHEMICALS.
Commonwealth Scientific and Industrial Research Organization, Victoria (Australia). Div. of Textile Industry.
J. R. Christoe.
Journal Water Pollution Control Federation, Vol. 49, No. 5, p 848-854, May, 1977. 9 fig, 3 tab, 29 ref.

Descriptors: *Textiles, *Industrial wastes, Biological treatment, Surfactants, Flocculation, Hydrogen ion concentration, Loads(Forces), Sulfates, Chlorides, Temperature, Performance, Evaluation, Polymers, Separation techniques, *Waste water treatment.
Identifiers: *Wool scouring effluents.

Several disadvantages were recognized in the use of 'acid-cracking' to destabilize wool scouring effluents. The process acidified effluents to a pH of less than four with sulfuric acid. This was the only chemical treatment process which allowed wool grease recovery. It was less effective on effluents containing non-ionic surfactants due to the poor and variable phase separation. The clarified phase contained 70% of the original BOD and 30% of the original grease. Recovered grease had a high free fatty-acid content and a dark color. Various chemicals used in the process and other factors were evaluated. The optimum pH range was found to be pH 5 to 6. Alum and ferric chloride were chosen as the most suitable chemicals because they were most economical, and their sludges were dewaterable without further treatment. Restabilization of flocculated or coagulated matter from overdosing was not apparent because of the amount of flocculable material in the liquor. Sulfate and chloride ions were compared. It was found that there was no significant effect on destabilization as a function of nominal cation content. On a weight-effectiveness basis, there were significant differences. The solubility of non-ionic surfactants was temperature-dependent because wool grease melts at about 40 °C. The amount of pollutant removed decreases significantly above the softening temperature. Both the degree and duration of stirring had no effect on the chemical treatment. Biological pretreatment that creates a 5-10% reduction in BOD or COD can result in the removal of more pollutants per unit mass of flocculant. Polymeric flocculants can be used alone or as flocculant aids. Their selection must depend upon their properties. (Collins-FIRL)
W77-09425

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOLUME 1. EXECUTIVE SUMMARY.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09451

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PET. REFINING IND. VOL. 2, PTS 1 AND 2. IND. DESCRIPTION AND TECH. ANALYSIS.
Sobotka and Co., Inc., Stamford, Conn.

For primary bibliographic entry see Field 5G.
W77-09452

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOL. 3, PT. 3. ECONOMIC IMPACT ANALYSIS.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09453

RESTORING THE WILLAMETTE RIVER: COSTS AND IMPACTS OF WATER QUALITY CONTROL.
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 5G.
W77-09455

THE ECONOMIC IMPACT OF ENVIRONMENTAL PROGRAMS.
Council on Environmental Quality, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-09457

A STUDY OF DISPOSAL OF CAMPGROUND WASTES ADJACENT TO WALDO LAKE, OREGON.
Pacific Northwest Environmental Research Lab., Corvallis, Ore.
J. R. Tilstra, K. W. Malueg, and C. F. Powers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 331, Price codes: A03 in paper copy, A01 in microfiche. Working Paper No 7, February 1973. 24 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Camp sites, *Septic tanks, *Soil disposal fields, Recreation facilities, *Waste disposal, *Oregon, Pacific Northwest US, Analytical techniques, Effluents, Base flow, Groundwater, Water pollution, Nitrogen, Phosphorus.
Identifiers: *Waldo Lake(Ore).

Methods for characterizing a groundwater flow regime in areas considered, or actively used for disposal of septic tank effluents by soil absorption and to determine the effectiveness of a rocky volcanic soil for the breakdown and retention of nitrogen and phosphorus from septic effluents were introduced at a new campground septic tank treatment and disposal system at Islet Campground, adjacent to Waldo Lake, Oregon. Water level elevations, well logs, phosphorus and nitrogen analyses, and tracers were used to define the hydrology of the drainfield. Results indicated that septic tank effluents incorporated with native groundwater did not enter the lake during the July to September study period, suggesting that the main aquifer was not connected to the lake. It is concluded that: (1) the aquifer was of limited permeability, contained a highly fractured zone between two bedrock layers, so that the possibility exists that system failure could eventually lead to complete clogging of the fractures forcing the septic tank effluent into the lake, (2) because of the limited permeability of the aquifer, periods of high natural recharge would greatly reduce its capacity to accommodate effluents, and (3) since many recreational lakes in the Western U.S. are located in similar geologic conditions and of most of these lakes are fragile, special precautions are needed in the design and location of adjacent waste disposal systems. (Luedtke-Wisconsin)
W77-09471

ECONOMIC ASSESSMENT OF PROPOSED TOXIC POLLUTANT EFFLUENT STANDARDS FOR MANUFACTURERS AND FORMULATORS OF ALDRIN/DIELDRIN, DDT, ENDRIN AND TOXAPHENE.
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.

W77-09478

ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES: INORGANIC CHEMICALS INDUSTRY.
Versar, Inc., Springfield, VA.
For primary bibliographic entry see Field 5E.
W77-09480

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL.
Ohio State Univ. Research Foundation, Columbus.
For primary bibliographic entry see Field 5G.
W77-09481

CHLORINE-CONTAINING STABLE ORGANICS: NEW COMPOUNDS OF ENVIRONMENTAL CONCERN.
For primary bibliographic entry see Field 5C.
W77-09492

POLLUTION OF THE INTERSTATE AND INTRASTATE WATERS OF THE UPPER MISSISSIPPI RIVER AND ITS TRIBUTARIES.
For primary bibliographic entry see Field 5G.
W77-09529

PACKAGE AERATION PLANTS.
Arizona State Dept. of Health Services, Phoenix.
Environmental Health Services.
Engineering Bulletin, No 15 (Supp to Eng Bulletin, No 11), 1971. 5 p, 2 tab.

Descriptors: *Solid wastes, *Sludge disposal, *Environmental sanitation, *Sewage disposal, Sludge, Disposal, Waste disposal, Municipal wastes, Sludge treatment, Anaerobic digestion, Chlorination, Administration, Costs, Septic tanks, *Waste water treatment, Treatment, Domestic wastes, Settling basins, Water pollution sources.

The extended aeration system simplifies the activated sludge process by eliminating the primary settling tank and anaerobic sludge digestion unit. The difficult sludge handling problem is minimized by combining various tanks and other facilities into one structural unit called the 'package plant', thus reducing the quantity of sludge generated. The extended aeration system will effectively treat sewage from small installations so that effluents can be discharged into the environment with no greater health hazard than is associated with larger conventional treatment plants. General information covered by the bulletin includes design criteria, sludge handling and wasting facilities, solids control, holding and settling tanks, and data on operations and costs. (Hadoulas-Florida)
W77-09588

OPTIMAL CONTROL OF AN UNSTEADY STATE CONTINUOUS ACTIVATED SLUDGE SYSTEM: A COMPARISON OF DIGITAL COMPUTER SIMULATION VS PILOT PLANT RESULTS.
Toledo Univ., Ohio.
A. B. Shahalam.
Ph D Thesis, 1976. 192 p.

Descriptors: *Model studies, *Sludge treatment, *Activated sludge, *Computer models, *Pilot plant, Sewage effluent, Performance, Control, Aeration, *Waste water treatment.
Identifiers: Sludge thickening.

A dynamic model of the activated sludge process was developed. This involved an aerator, a thickener and sludge recycle. System variables were the microorganism and substrate concentrations. System control was by detention time in the aerator and the sludge wastage rate. Analysis was made of continuous sinusoidal variations in in-

fluent substrate and microorganism levels. A digital computer simulation was used to illustrate the effects of variable waste quality on effluent quality with and without optimal system control. A laboratory scale pilot activated sludge system employing synthetic glucose waste was studied to determine the unsteady state system responses. Comparisons of the pilot system and the model indicated a close correlation. It was determined that optimal control techniques would help to produce substantial effluent quality improvements. (Collins-FIRL)
W77-09597

POWDERED ACTIVATED CARBON ADDITION TO BIOLOGICAL REACTORS.
Delaware Univ., Newark.
F. L. Robertaccio.
Ph D Thesis, 1976. 349 p.

Descriptors: *Activated carbon, *Biological treatment, *Kinetics, *Tertiary treatment, *Waste water treatment, Mass transfer, Adsorption, Models, Microorganisms.
Identifiers: Biological reactors.

The addition of powdered activated carbon to biological reactors has proven an uncomplicated way to achieve tertiary treatment water quality. The kinetics of biodegradable substrate in a pure biological system and in one with powdered activated carbon was investigated. Results indicated that the maximum utilization rate for adsorbable substrates was enhanced in direct proportion to the amount of activated carbon present. Non carbon-adsorbent substrates showed no enhancement and the effectiveness of activated carbon was lessened in a biological system. The adsorbency of a degradable substrate is a prime parameter in the determination of whether the presence of activated carbon in a biological system produces synergistic effects. The presence of activated carbon can overcome mass transfer constraints. Enhancement of substrate utilization in a carbon-biological system was independent of the assumed kinetic model. Batch system models which predicted substrate utilization could not describe gravimetrically determined biological solids growth. The presence of activated carbon was assumed to change the distribution of species in biological populations. Mass transfer at carbon-substrate-microbial interface was enhanced. (Collins-FIRL)
W77-09599

METALS IN THE AQUEOUS EFFLUENTS FROM MUNICIPAL INCINERATORS AND AN INCINERATOR-RESIDUE PROCESSING PLANT.
Maryland Univ., College Park.
For primary bibliographic entry see Field 5A.
W77-09600

5E. Ultimate Disposal Of Wastes

OPTIMAL ARTIFICIAL AERATION POLICY FOR WATER QUALITY CONTROL OF STREAMS RECEIVING MULTIPLE THERMAL AND SEWAGE DISCHARGES.
Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5G.
W77-09147

AN OVERLAND FLOW - LAGOON RECYCLE SYSTEM AS A PRETREATMENT OF POULTRY WASTES.
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 5D.
W77-09148

WASTE ALLOCATIONS IN THE BUFFALO (NEW YORK) RIVER BASIN.
Versar, Inc., Springfield, Va.
For primary bibliographic entry see Field 5B.
W77-09168

MAY 1974 BASELINE INVESTIGATION OF DEEPWATER DUMPSITE 106.
National Oceanic and Atmospheric Administration, Washington, D.C.; and Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5B.
W77-09243

INVESTIGATION OF RADIOACTIVE WASTE DISPOSAL AT DEEPWATER DUMPSITE 106—SAMPLING PROGRAM MAY 1974.
Office of Radiation Programs, Washington, D.C.
For primary bibliographic entry see Field 5B.
W77-09246

LAND APPLICATION OF WASTE WATER, A BIBLIOGRAPHY.
Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5D.
W77-09265

MICROBIOLOGICAL STUDY OF FAUNAL RESPONSE TO SPRAY IRRIGATION OF CHLORINATED SEWAGE EFFLUENT.
Pennsylvania State Univ., University Park. Dept. of Veterinary Science.
For primary bibliographic entry see Field 5C.
W77-09270

RENOVATION RESPONSE TO APPLICATION FREQUENCIES FOR GRASS FILTRATION TREATMENT OF SEWAGE EFFLUENT.
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W77-09271

PROCEEDINGS OF THE EIGHTH DREDGING SEMINAR.
Texas A and M Univ., College Station. Center for Dredging Studies.
For primary bibliographic entry see Field 2L.
W77-09325

FINE-GRAINED SEDIMENT AND INDUSTRIAL WASTE DISTRIBUTION AND DISPERSAL IN NEW BEDFORD HARBOR AND WESTERN BUZZARDS BAY, MASSACHUSETTS.
Woods Hole Oceanographic Institution, Mass. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5B.
W77-09326

SEWAGE DISCHARGES FROM SHIPS TRANSITING COASTAL SALT WATERS.
David W. Taylor Naval Ship Research and Development Center, Annapolis, Md. Pollution Abatement Div.
For primary bibliographic entry see Field 5B.
W77-09333

SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT.
Delaware Univ., Newark. Center for Remote Sensing.
For primary bibliographic entry see Field 5B.
W77-09358

DESIGN PARAMETERS FOR THE LAND APPLICATION OF DAIRY MANURE.
Cornell Univ. Agricultural Experiment Station, Ithaca, N. Y. Dept. of Agronomy.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal Of Wastes

For primary bibliographic entry see Field 5D.
W77-09397

LIVESTOCK AND THE ENVIRONMENT, A BIBLIOGRAPHY WITH ABSTRACTS—VOLUME III.

East Central Oklahoma State Univ., Ada. School of Environmental Science.

For primary bibliographic entry see Field 5D.
W77-09398

CONVERSION OF CATTLE FEEDLOT WASTES TO AMMONIA SYNTHESIS GAS,

Texas Tech Univ. Lubbock. Dept. of Chemical Engineering.

For primary bibliographic entry see Field 5D.
W77-09401

SURVIVAL OF PATHOGENS IN ANIMAL MANURE DISPOSAL,

Minnesota Univ., St. Paul. Coll. of Veterinary Medicine.

For primary bibliographic entry see Field 5B.
W77-09402

SOME CONSIDERATIONS ON THE RECOVERY AND DISPOSAL OF PHOTOLAB WASTE,

For primary bibliographic entry see Field 5D.
W77-09411

REFINERY EFFLUENT IMPROVED BY GRAVITY-PRESSURE DEWATERING,

Ecodyne Corp., Union, N.J.

For primary bibliographic entry see Field 5D.
W77-09420

A STUDY OF DISPOSAL OF CAMPGROUND WASTES ADJACENT TO WALDO LAKE, OREGON,

Pacific Northwest Environmental Research Lab., Corvallis, Ore.

For primary bibliographic entry see Field 5D.
W77-09471

ENVIRONMENTAL IMPACTS OF HIGH LEVEL RADIOACTIVE WASTE DISPOSAL,

Pittsburgh Univ., Pa.

For primary bibliographic entry see Field 5C.
W77-09473

ASSESSMENT OF INDUSTRIAL HAZARDOUS WASTE PRACTICES: INORGANIC CHEMICALS INDUSTRY,

Versar, Inc., Springfield, VA.
R. G. Shaver, L. C. Parker, E. F. Rissman, K. M. Slimak, and R. C. Smith.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 832. Price codes: A22 in paper copy, A01 in microfiche. Report No. EPA/530/SW-104c, March 1975. 501 p. 138 fig., 73 tab., 96 ref., 3 append. EPA 68-01-2246.

Descriptors: *Chemical industry, *Water pollution sources, *Industrial wastes, *Waste disposal, *Landfills, *Waste dumps, Inorganic compounds, Chlorine, Asbestos, Lead, Mercury, Chlorinated hydrocarbon pesticides, Fluorides, Arsenic compounds, Lagoons, Chemicals, Alkalies(Bases), Gases, Pigments, Dyes, Hazards.

The 1,067 U.S. plants manufacturing 112 million metric tons of various chemicals in 1974 also generated approximately 40 million metric tons (dry basis) of land-destined wastes, of which 2 million metric tons were considered potentially hazardous. The major industry groups involved in this waste discharge are the alkalies and chlorines processors, industrial gas producers, makers of inorganic pigments and manufacturers of industrial

inorganic chemicals such as sulfuric acid, hydrofluoric acid, alum, sodium sulfide and phosphorus. Plants using the mercury cell process for the manufacture of chlorine are a prominent source of pollution from industrial waste treatment systems. Some of the potentially hazardous constituents identified in the waste streams from inorganic chemical manufacturing operations are asbestos, lead, mercury, chlorinated hydrocarbons, fluorides, arsenics and antimony compounds. The prevalent disposal method is distribution on land, with about 85% of the wastes deposited in landfills, lagoons and dumps. The assessment includes a general discussion of the inorganic chemicals industry, characterizations of the sub-industries and their wastes, descriptions of treatment and disposal technologies, and cost analysis of disposal. (Harris-Wisconsin).
W77-09480

THE ECOLOGICAL BEHAVIOR OF PLUTONIUM AND AMERICIUM IN A FRESHWATER POND,

Battelle Pacific Northwest Labs., Richland, Wash. Ecosystems Dept.

For primary bibliographic entry see Field 5C.
W77-09501

PACKAGE AERATION PLANTS.

Arizona State Dept. of Health Services, Phoenix. Environmental Health Services.

For primary bibliographic entry see Field 5D.
W77-09588

DIGESTED SLUDGE: DELINEATION AND MODELING FOR OCEAN DISPOSAL,

California Inst. of Tech., Pasadena.
W. K. Faisst.

Ph D Thesis, 1976. 215 p.

Descriptors: *Computer models, *Sewage disposal, *Sludge digestion, *Sludge disposal, *Ultimate disposal, Sedimentation, Metals, Trace elements, Analysis, Model studies, Sulfides.
Identifiers: Los Angeles County(Calif), Land disposal, Ocean disposal.

A study was conducted to gather data on digested sludge particles and related trace metals to develop a model of digested sludge discharge in ocean disposal. Digested sludge particles in the test area, Los Angeles County (California) Sanitation Districts, were measured for size. Ninety percent of these had diameters of less than 10 microns. Of nine trace metals studied, only manganese had a dissolved fraction greater than 1% of the total metal. Sedimentation velocities of this sludge decreased as the dilution factor increased. Sedimentation of chromium, copper, iron, nickel, lead, and zinc was approximately the same as that of sludge particles. About 10% of filterable solids dissolved or oxidized in oxic mixtures. A hydraulic computer simulation indicated that sludge effluent discharges at depths of 730 m rise no more than 120 m. Analysis showed that solids reach the sediments within 10 kilometers of the discharge point. Other data revealed that nearly anoxic waters would become wholly anoxic from the sludge discharges. Chemical-equilibrium models showed that trace metals, except chromium and manganese, would be controlled by metal sulfide solids precipitation at dilutions up to 3000. It was concluded that trace metals in sludge would be immobilized in anaerobic bottom sediments of the basins and no life forms higher than bacteria were in the area to be disrupted. Ocean discharge would eliminate potentially expensive land disposal alternatives. Ocean surface waters would also be protected. (Collins-FIRL)
W77-09596

EFFECTS OF ANAEROBICALLY DIGESTED SEWAGE SLUDGE ON ORGANIC MATTER IN SOIL AND SOIL WATER,

Illinois Univ. at Urbana-Champaign.

For primary bibliographic entry see Field 5C.
W77-09598

5F. Water Treatment and Quality Alteration

SYSTEM DESIGN OF A TUBULAR REVERSE OSMOSIS PLANT,

California Univ., Los Angeles.
V. Goel, and J. W. McCutchan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 641. Price codes: A09 in paper copy, A01 in microfiche. Water Resources Center Desalination Report No. 64, UCLA-ENG-7704, School of Engineering and Applied Science, University of California, Los Angeles, January 1977. 186 p., 28 fig., 5 tab., 89 ref., 2 append.

Descriptors: *Water treatment, *Desalination plants, *Reverse osmosis, *Optimization, Economic efficiency, Simulation analysis, Dynamic programming, Computer models, *Design, Colorado River, Irrigation water, Drainage, Equations, Systems analysis.
Identifiers: Cost minimization, Parametric programming, Sensitivity analysis, Environmental impact.

Presented is a system approach to design of a one-inch diameter tubular module reverse osmosis desalination plant. The total system is divided into relevant subsystems: pretreatment, reverse osmosis, energy recovery, post-treatment, and brine disposal. Dynamic programming is utilized to minimize the unit cost of desalinated water. Product recovery is used as a parameter, and six discrete values of product recovery between 50% and 95% are considered. For optimization of the reverse osmosis subsystem, a parametric programming coupled with simulation model is developed. A periodic flow-reversal valve is incorporated into the reverse osmosis unit, eliminating the need for varying membrane permeability along the tube length. Seven values of operating pressure between 200 psig and 1500 psig, and four values of membrane annealing temperature between 76 and 93 C are considered. Membrane permeability coefficients for CA 400-25 cellulose acetate membranes, and functional relationships between operating parameters and membrane performance, are derived from laboratory and field tests. Performance data from field tests on Colorado River water at Metropolitan Water District's treatment plant at LaVerne, California are presented and minimum energy requirements calculated. The modes are programmed on the IBM 360-91 computer and used to design 1 million gallon per day plants for two desalination applications. Optimal designs are presented and sensitivity analysis is carried out. Results show that the reverse osmosis system can be designed to be an effective process for desalting Colorado River water and irrigation drainage flows. (Bell-Cornell)
W77-09319

BINGHAMTON WASTEWATER MANAGEMENT STUDY: DESIGN AND COST APPENDIX.

Army Engineer District, Baltimore, Md.

For primary bibliographic entry see Field 5G.
W77-09385

DO ECONOMIES OF SCALE EXIST IN WATER UTILITY,

Illinois Univ. at Urbana-Champaign. Coll. of Commerce and Business Administration.
H. Hinomoto.
Faculty Working Paper 290, November 1975. 3 tab., 13 ref.

Descriptors: *Treatment facilities, *Diseconomies of scale, Water treatment, *Economies of scale, Cost comparisons, Capital costs, Operating costs, Costs, Construction costs, *Utilities.
Identifiers: Plant capacity(Water treatment).

Relationships between the capacity of 17 surface water treatment plants and the construction costs of their major components were analyzed to determine if economies of scale existed. Based on cost data obtained from the original contractual documents, the study indicated diseconomies of scale existed in each of the major components of the 1-12 mgd capacity plants. The most significant factor influencing the capital cost of the plant was the source of the water treated. Because surface water, in general, is more polluted and requires a higher degree of treatment than groundwater, the capital cost of a surface water plant generally is substantially greater than that of the same capacity groundwater treatment plant. Most large water treatment plants use surface water sources. The scale effects on the total unit cost of treatment, including operating and capital costs, were not as conclusive because of the lack of complete operating cost data. However, based on available data, the total unit cost first decreased, reaching the minimum at about 6.0 mgd, and then increased again as the capacity moved from 1 to 12 mgd, suggesting an optimum size of around 6 mgd. (Luedtke-Wisconsin)

W77-09450

5G. Water Quality Control

OPTIMAL ARTIFICIAL AERATION DESIGN IN POLLUTED STREAMS RECEIVING THERMAL DISCHARGE

Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
S. H. Lin, L. T. Fan, and C. L. Hwang.
Kansas Water Resources Research Institute, Manhattan, Contribution Number 127, (1975). 32 p, 12 fig, 14 ref. OWRT B-030-KAN(10), 14-31-0001-3592.

Descriptors: Water quality, *Water pollution control, *Aeration, Thermal pollution, Design criteria, Dissolved oxygen, Cooling water, Water quality standards.

Identifiers: *Optimal artificial aeration scheme, *Thermal discharge, *Continuous maximum principle, *Organic waste discharges, Optimal control policy, Minimum DO concentration, Non-zero artificial aeration.

The optimal artificial aeration scheme for a polluted stream which receives additional thermal discharge is studied. The continuous maximum principle is employed to find the optimal control policy which minimizes the system objective function and maintains an appropriate water quality in the stream. The system objective function which consists of the DO violation penalty from the desired value and the artificial aeration effort increases significantly with increasing amount of thermal discharge in comparison with the isothermal case. The system objective function also increases exponentially with increasing upstream BOD concentration. A design procedure is presented to find the optimal artificial aeration control policy which is able to maintain the water quality at a minimum legal requirement.

W77-09146

OPTIMAL ARTIFICIAL AERATION POLICY FOR WATER QUALITY CONTROL OF STREAMS RECEIVING MULTIPLE THERMAL AND SEWAGE DISCHARGES

Kansas State Univ., Manhattan. Dept. of Chemical Engineering.
S. H. Lin, L. T. Fan, and C. L. Hwang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 347. Price codes: A03 in paper copy, A01 in microfiche. Kansas Water Resources Research Institute, Manhattan, Contribution Number 135, (1975). 38 p, 12 fig, 1 tab, 14 ref. OWRT Project B-037-KAN(3), 14-31-0001-4086.

Descriptors: *Thermal pollution, *Water quality control, *Aeration, Algorithms, *Design criteria, Cooling water, *Optimization, *Sewage outfalls, Sewage effluents, Water quality standards.
Identifiers: *Optimal artificial aeration, Thermal discharge, Sewage discharge, Objective function, Complex maximum principle algorithm.

The optimal artificial aeration design of a polluted stream is investigated in light of a criterion of the minimum cost which consists of the sum of the cost representing the penalty for the CO concentration deviation from the desired value and the cost of artificial aeration. The system considered is a reach of a stream containing multiple discharges of cooling water and sewage waste. The optimal artificial aeration control policies are determined by the modified maximum principle for different multiple-outfall configurations. The effects of the thermal and sewage discharges on the stream water quality as well as on the optimal artificial aeration control policy are examined. As the number of outfalls increases, the stream water quality is significantly improved. For the case where waste discharges are excessive, the multiple outfall system offers an additional advantage in minimizing localized severe pollution.

W77-09147

TECHNOLOGY AND ECONOMICS OF PACKED COLUMN WATER OXYGENATION IN STREAM AERATION

Rutgers - The State Univ., New Brunswick, N. J. Dept. of Chemical and Biochemical Engineering.
F. W. Dittman, and M. Lothman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 336. Price codes: A02 in paper copy, A01 in microfiche. Delivered at VI Interamerican Congress of Chemical Engineering, Caracas, Venezuela, July 13-16, 1975. 19 p, 4 fig, 2 tab, 10 ref. OWRT B-010-NJ(3), B-011-NJ(2), B-022-NJ(8).

Descriptors: *Reaeration, *Water pollution control, Water quality control, *Oxygenation, Biochemical oxygen demand, *Economics, *Technology, *Aeration.
Identifiers: *Instream aeration.

Work on oxygen absorption in water in a packed column began because of the need, in some cases, for an alternative to instream aeration devices. Instream aeration devices, such as surface aerators or diffuser pipes with air compressors, are economically feasible and are being used routinely for the aeration of polluted streams in a number of places. They are subject to a number of disadvantages, however, which are enumerated. Stream aeration in a packed column results in a power consumption per unit of oxygen absorbed equal to, or less than, those required for surface aerators or diffusers. The capital costs of absorption column systems would benefit from the economies of scale as the size of the unit increases, while economies of this type are difficult to achieve with surface aerators.

W77-09149

ENVIRONMENTAL MODELING AND SIMULATION, PROCEEDINGS OF THE CONFERENCE ON

Environmental Protection Agency, Washington, D. C. Office of Research and Development.
For primary bibliographic entry see Field 5B.

W77-09154

FUTURE ENVIRONMENTAL QUALITY MANAGEMENT USING MODELS

Environmental Research Lab., Athens, Ga.
D. W. Duttweiler.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 10-13, July 1976. 23 ref.

Descriptors: *Environmental control, *Management, *Mathematical models, Water quality control, Pollution abatement, Social aspects, Simulation analysis, Decision making, Systems analysis.

The purpose of this paper is threefold: (1) to show environmental pollution control officials and managers the potential of models for enhancing the efficiency and effectiveness of their efforts; (2) to suggest to modelers that their products can be more useful in environmental protection; and (3) to outline a future mode of action for environmental protection that could be superior, in its accomplishments and costs, to the present approach which is highly limited in scope. The concept of the environment as a system is outlined and 'pollution control' is compared to 'environmental quality management'. Steps to realize environmental quality management through use of models are described and the potential benefits of instituting environmental quality management are discussed. A modeling approach to solving society's pollution problems, employing a holistic view of both the environment and society, would allow the environment to be managed to achieve the objectives society chooses. The systems approach forces recognition of the interconnectedness of environment and society and provides the means for evaluating the impact of projected social changes on the environment and of environmental changes on society. (See also W77-09154) (Bell-Cornell)

W77-09155

A SYSTEMATIC APPROACH TO REGIONAL WATER QUALITY PLANNING

Systems Control, Inc., Palo Alto, Calif.
G. P. Grimsrud, and E. J. Finnemore.
In: Proceedings of the EPA Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA-9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 14-19, July 1976. 2 fig, 2 tab, 9 ref.

Descriptors: *Water quality control, *Regional analysis, *Methodology, Alternative planning, Computer models, Management, *Washington, River basins, Economics, Costs, Sewage, Runoff, Flow, Systems analysis.

Identifiers: Cost-effectiveness, Snohomish River basin(Wash), Stillaguamish River basin(Wash).

Described are various methodologies developed for regional water quality management planning on the Snohomish and Stillaguamish River Basins in Washington. These methods were specifically designed to be responsive to future changes in state and federal legislation, land use, economics, population, employment, geographical and political boundaries, technological development, and changes in the natural or man-made conditions of the water bodies. Computer models were developed and utilized to project future sewage and runoff flows, determine the assimilative character of water bodies, plan and cost various alternative wastewater management plans and provide other information on the cost-effectiveness of alternatives necessary for completing the Water Quality Management Plans. The modeling and programming elements are the principal factors allowing the development of a dynamic and easily updated Water Quality Plan. Considered herein are: planning procedure; flow regimes; determination of alternatives; wasteload allocation; assimilation analysis; wasteload forecasts; costs of alternatives; cost-effectiveness comparisons; and time-phased facility schedule. (See also W77-09154) (Bell-Cornell)

W77-09156

RIBAM, A GENERALIZED MODEL FOR RIVER BASIN WATER QUALITY MANAGEMENT PLANNING

Raytheon Co., Portsmouth, R.I. Environmental Systems Analysis.
R. N. Marshall, S. G. Chamberlain, and C. V. Beckers, Jr.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

In: Proceedings of the EPA Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 45-49, July 1976. 3 fig, 1 tab, 4 ref.

Descriptors: *Simulation analysis, *Water quality control, *Computer models, Planning, Management, River basins, Chemical properties, Analytical techniques, Wastes, Streams, Ohio, Pennsylvania, Equations, Systems analysis.

To meet water quality objectives in streams and rivers, a need arises for systematic analysis of alternative pollution abatement strategies. The computerized mathematical model, RIBAM (River Basin Model), predicts water quality for 17 constituents, including DO, carbonaceous BOD, and parameters that represent nitrification and photosynthetic processes. RIBAM is suited for determining the waste load allocations necessary for achieving water quality standards in rivers. A unique calibration method, based on open-channel hydraulic equations, for an exponential relationship between stream velocity and flow is presented. Basic assumptions of the computer simulation model are that steady-state conditions exist and that the concentrations of water quality parameters are well mixed, varying only in the longitudinal direction of the stream. Application of RIBAM to the Beaver River Basin, including the Mahoning River, in Ohio and Pennsylvania is discussed. It is concluded that RIBAM is useful for river basin quality planning and management. Predicted water quality profiles for different basin conditions can be analyzed to aid in determining the waste load conditions that are most suitable to the water quality objectives of the basin. (See also W77-09154) (Bell-Cornell)
W77-09158

COMPARISON OF EUTROPHICATION MODELS,
Environmental Protection Agency, Atlanta, Ga. Technical Support Branch.
For primary bibliographic entry see Field 5C.
W77-09159

PLANNING IMPLICATIONS OF DISSOLVED OXYGEN DEPLETION IN THE WILLAMETTE RIVER, OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 5B.
W77-09160

PLANNING MODELS FOR NON-POINT RUNOFF ASSESSMENT,
Environmental Protection Agency, Athens, Ga. Ambient Monitoring Section.
For primary bibliographic entry see Field 5B.
W77-09162

A MATHEMATICAL MODEL OF DISSOLVED OXYGEN IN THE LOWER CUYAHOGA RIVER,
Cleveland State Univ., Ohio.
For primary bibliographic entry see Field 5B.
W77-09163

A WATER RESIDUALS INVENTORY FOR NATIONAL POLICY ANALYSIS,
National Academy of Sciences, Washington, D.C. E. H. Pechan, and R. A. Luken.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 106-110, July 1976. 2 tab, 10 ref.

Descriptors: *Water pollution control, *Water policy, Effects, Effluents, Costs, Standards, Water quality, Waste discharge, Computers, Industries, Technology, Pollution abatement, Simulation analysis, Systems analysis.

Identifiers: *Residuals control, *Residuals discharge, Alternative policies, National policy.

A computer-based water residuals generation and discharge inventory was developed to assist in the evaluation of regional and national implications of the uniform effluent requirements of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) and in the evaluation of alternative residuals control policies. The completed system, termed the National Residuals Discharge Inventory (NRDI), has been used to examine the effects of various abatement policies at the regional level. The model is unique in its capability to simultaneously estimate costs, residuals discharge, and residuals dilution effects of alternative policies. This article discusses the application of the model to evaluate three alternative policies' residuals dilution effects in terms of national uniform effluent standards. Major limitations of the system include its omission of some important sources, i.e., silviculture, and its narrow coverage of residuals. (See also W77-09154) (Bell-Cornell)
W77-09164

STREAM MODELING AND WASTE LOAD ALLOCATION,
Indiana State Board of Health, Indianapolis. Div. of Water Pollution Control.
For primary bibliographic entry see Field 5B.
W77-09169

SIMULATION OF AGRICULTURAL RUNOFF,
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5B.
W77-09173

AN ENVIRONMENTAL RESIDUAL ALLOCATION MODEL,
Energy Resources Co. Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5B.
W77-09179

WATER QUALITY MODELING IN TEXAS,
Texas Water Quality Board, Austin. Engineering Analysis and Modeling Section.
For primary bibliographic entry see Field 5B.
W77-09181

A DYNAMIC WATER QUALITY SIMULATION MODEL FOR THE THAMES RIVER,
Ontario Ministry of the Environment, Toronto (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 5B.
W77-09182

DISPERSION MODEL FOR AN INSTANTANEOUS SOURCE OF POLLUTION IN NATURAL STREAMS AND ITS APPLICABILITY TO THE BIG BLUE RIVER (NEBRASKA),
Nebraska Natural Resources Commission, Lincoln.
For primary bibliographic entry see Field 5B.
W77-09183

SELECTING THE PROPER REAERATION COEFFICIENT FOR USE IN WATER QUALITY MODELS,
Texas Water Quality Board, Austin. Administrative Operations.
A. P. Covar.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 340-343, July 1976. 3 fig, 16 ref.

Descriptors: *Water quality, *Mathematical models, *Equations, *Reaeration, Environmental engineering, Systems analysis, Streams, Flow, Natural streams, Laboratory tests, Oxygen, Turbulent flow, Atmosphere, Forecasting.

Identifiers: Field studies.

The arbitrary selection of an equation to predict the reaeration coefficient can significantly bias the results of an analysis. Reviewed are various methods for calculating atmospheric reaeration coefficients for use in mathematical water quality models; among those methods considered are that of Streeter and Phelps, of O'Connor and Dobbins, and of Churchill, Elmore, and Buckingham. In view of these existing methods, a rational engineering methodology is developed to guide the engineer in the selection of the appropriate predictive equation. It is concluded that equations derived from very shallow laboratory flume data should not be applied to natural streams which probably have entirely different hydraulic characteristics. Equations derived from field studies are best applied in instances where stream conditions are similar to those from which the equations were derived. (See also W77-09154) (Bell-Cornell)
W77-09184

RECEIV-II, A GENERALIZED DYNAMIC PLANNING MODEL FOR WATER QUALITY MANAGEMENT,
Raytheon Co., Portsmouth, R.I. Oceanographic and Environmental Services.
For primary bibliographic entry see Field 5B.
W77-09185

A RESOURCE ALLOCATION MODEL FOR THE EVALUATION OF ALTERNATIVES IN SECTION 208 PLANNING CONSIDERING ENVIRONMENTAL, SOCIAL AND ECONOMIC EFFECTS,
Grumman Ecosystems Corp., Bethpage, N.Y. D. Hill.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 401-406, July 1976. 1 fig, 5 tab, 11 ref.

Descriptors: *Resource allocation, *Evaluation, *Model studies, *Alternative planning, *Environmental effects, *Social impact, *Economic impact, Land use, Water quality, Wetlands, Linear programming, Decision making, Systems analysis, Estuaries.
Identifiers: *Quantitative model, *Qualitative model, *Multiple objectives, Tradeoffs, Environmental modeling, Costs minimization, Environmental quality.

Modeling for 208 planning should be designed to facilitate participation by planners and representatives of the affected public. Intangibles and incommensurables must be considered, and the ultimate need for value judgments to assess the importance of environmental, social, and economic effects must be accommodated without obscuring the factual analysis. Ideally, population groups that are affected differently should be accounted for separately. Model building should therefore proceed in successive stages of greater precision. An initial qualitative analysis leads to a conceptual model that identifies the differential impacts of the alternatives, making only the judgment that the impacts are beneficial or detrimental. With land use decisions among the alternatives for satisfying water quality goals, a resource allocation model is useful to account for other costs and benefits. This can be solved for the minimum dollar cost mix of activities as a datum; alternative plans can then be generated by assigning additional importance to intangible and incommensurable values, with the plan selection informed by knowledge of its incremental dollar cost. (See also W77-09154) (Bell-Cornell)
W77-09192

REGIONAL RESIDUALS-ENVIRONMENTAL QUALITY MANAGEMENT MODELS: APPLI-

CATION TO EPA'S REGIONAL MANAGEMENT PROGRAMS.

Resources for the Future, Washington, D. C. Quality of the Environment Program. W. O. Spofford, and C. N. Ehler.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 407-413, July 1976. 1 fig, 19 ref.

Descriptors: *Regional analysis, *Environmental control, *Optimization, Water quality, Air pollution, Ecosystems, Mathematical models, Constraints, Standards, Evaluation, Linear programming, Cost analysis, Research, Systems analysis.

Identifiers: *Residuals, *Environmental quality, *Management programs, *Lower Delaware Valley, Public policy, Treatment plants, Cost minimization.

This paper describes the elements of a regional integrated residuals-environmental quality management model developed at Resources for the Future to assist governments in establishing public policy on regional environmental quality—air, water and land—through the explicit analysis of the linkages among gaseous, liquid and solid residuals, and among the various environmental media. Within an optimization framework, the model evaluates a large number of residuals management options including non-treatment alternatives, so that least-cost ways of achieving various levels of ambient environmental quality, subject to constraints on the geographic distribution of costs of achieving these levels, can be identified. The overall management model consists of three parts: a linear programming model of regional residuals generation and discharge, environmental models (air dispersion and aquatic ecosystem models), and an environmental evaluation section. A summary of results from a test application of the model in the Lower Delaware Valley is presented. Lessons learned from the development of the Delaware model are related to the objectives and analytic requirements of EPA's current regional management programs. Air Quality Maintenance and Area-wide Waste Treatment (208) plans. (See also W77-09154) (Bell-Cornell) W77-09193

TO ESTABLISH VIABLE METHODS OF MAINTAINING WASTE TREATMENT FACILITY EFFICIENCIES WITH REFERENCE TO FLOW VARIATIONS, VOLUME II.

MacLaren (James F.) Ltd., Toronto (Ontario). For primary bibliographic entry see Field 5D. W77-09214

UPGRADING OF SEWAGE LAGOON EFFLUENTS.

Ontario Ministry of the Environment, Toronto. Pollution Control Branch. For primary bibliographic entry see Field 5D. W77-09218

RESEARCH PROJECTS IN GLACIOLOGY - 1976.

Department of the Environment, Ottawa (Ontario). Water Resources Branch. For primary bibliographic entry see Field 2C. W77-09220

RESEARCH, DESIGN, AND DEVELOPMENT OF THE U.S. COAST GUARD HIGH SEAS OIL CONTAINMENT SYSTEM.

Battelle Columbus Lab., Ohio. J. M. Tierney. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 749, Price codes: A14 in paper copy, A01 in microfiche. U. S. Coast Guard Office of Research and Development, Washington, D. C., Report No.

CG-D-42-76, September 1975. 305 p, 56 fig, 9 tab, 42 ref, 5 append. DOT-CG-23223-A.

Descriptors: *Oil pollution, *Barriers, *Water pollution control, *Oil spills, *Pollution abatement, *Water quality control, Testing procedures. Identifiers: *Outer Continental Shelf, *Oil recovery systems, Oil containment.

The objective of this program was to develop a lightweight airdeliverable oil barrier system, capable of containing significant quantities of oil at sea states to 5-foot waves and 1-knot currents, and in winds up to 20 knots, and of sustaining with minimal damage 10-foot waves, 2-knot currents, and 40-knot winds. An inflatable-supported curtain barrier, a self-floating airdeliverable barrier-storage/deployment container, and barrier moorings were developed from initial concept stages to full-scale usable equipment. Model and field tests were conducted and modifications were made as required. An at-sea test of the interfaced subsystems demonstrated the validity of the final design and the viability of the air-delivery methods. The program resulted in a usable airdeliverable oil-containment system and in the specifications for manufacturing barriers, air-delivery/sea-deployment containers, and ship- and air-deliverable barrier moorings. (Sinha - OEIS) W77-09226

USERS MANUAL - OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM.

Environmental Protection Agency, Washington, D.C. Div. of Oil and Hazardous Materials. Available from the National Technical Information Service, Springfield, VA 22161 as PB-243 662, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency Report No. EPA/DF-75-001a, April 1975. 15 p.

Descriptors: *Oil spills, *Oil pollution, *Hazards, Water pollution, *Information retrieval, Baseline studies, Environmental effects, Resources development.

This manual is designed to provide guidance to those who prepare reports on spill episodes to the Division of Oil and Special Materials Control, and who expect to access the system for developing Regional analytical studies. The increasing number of spills reports and the need for more accurate statistical analysis of episodes, make it imperative that Regions report promptly and in accordance with this manual in order that data are available to the Congress, EPA top management, the Office of Management and Budget, and the Public. Even more important is the need for a capability to fully support the Spill Prevention program and assess its effectiveness. (Sinha-OEIS) W77-09229

THE ENVIRONMENTAL QUALITY MONITORING REPORT.

National Oceanic and Atmospheric Administration, Washington, D.C. Outer Continental Shelf Task Force.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 020, Price codes: A04 in paper copy, A01 in microfiche. February 1976. 66 p, 11 fig, 3 tab.

Descriptors: *Environmental control, *Baseline studies, *Pollution abatement, *Monitoring, Water quality control, Water pollution control, Oil pollution, Trace elements, Pollutant identification, Metals. Identifiers: *Outer Continental Shelf, Trace metals.

The general requirements for environmental quality monitoring is defined, including strategies, certain general methodologies, management coordination with the program as well as with other programs, necessary research and development,

and required resources. The monitoring program is designed to inform users and be reactive to their needs. The basic strategy behind the monitoring program begins with identifying critical species, habitats, and processes in the course of the baseline investigations. Special studies will yield further understanding of the effects of oil and associated contaminants on various species and increase knowledge of the role of these species in the entire ecosystem. The studies will yield data in the location of OCS oil operations; on water mass circulation downcurrent from the potential pollutant sources; on living natural resources in jeopardy from possible oil contamination; and regarding the tolerance of these species to oil and associated trace metal concentrations. (Sinha-OEIS) W77-09231

ASSEMBLY AND TESTING OF THE MARK I SHIPBOARD SEPARATOR SYSTEM.

Foster-Miller Associates, Inc., Waltham, Mass. A. R. Guzzdar, A. C. Harvey, and W. M. Mack, Jr. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 948, Price codes: A04 in paper copy, A01 in microfiche. U.S. Coast Guard Office of Research and Development, Washington, D.C., Final Report No. CG-D-18-76, December 1975. 66 p, 21 fig, 10 tab, 1 ref, append.

Descriptors: *Water pollution control, *Pollution abatement, *Oil pollution, *Separation techniques, Testing. Identifiers: *Outer Continental Shelf, *Oil-water separation, Bilge water.

Assembly and testing of a prototype oil-water-solids separating system is described. The system is designed to process ships' bilge water at a rate of 50 gpm and provide water effluent containing less than 15 ppm of oil. Results of the system testing indicates that the system is capable of continuously processing 50 gpm of bilge water containing concentrations up to 20% No. 2 fuel oil and discharging water effluent with less than 7 ppm oil. Higher inlet oil concentrations are handled satisfactorily by the automatic recirculation feature of the system. (Sinha-OEIS) W77-09234

ANALYSIS OF RISK IN THE WATER TRANSPORTATION OF HAZARDOUS MATERIALS.

National Academy of Sciences, Washington, D.C. Committee on Hazardous Materials. Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 298, Price codes: A06 in paper copy, A01 in microfiche. U.S. Coast Guard Office of Research and Development, Washington, D.C. Final Report No. CG-D-39-76, January 1976. 118 p, 17 ref, 6 append.

Descriptors: *Transportation, *Hazards, *Water pollution control, *Risks, Pollution abatement, Model studies, Management, Decision making. Identifiers: *Outer Continental Shelf, *Risk analysis modeling, *Hazardous materials transport.

The Risk Analysis and Hazard Evaluation Panel of the Committee on Hazardous Materials, Office of Chemistry and Chemical Technology, Assembly of Mathematical and Physical Sciences prepared this report in response to a request from the U.S. Coast Guard for an assessment of the utility and feasibility of risk analysis as a set of techniques for assisting management decisions regarding the regulation of water transportation of bulk hazardous materials. The Panel surveyed a number of risk analysis studies, selected barge transportation on inland waterways for special study, and selected a probabilistic model of risk. In the course of the Panel's ongoing review of risk analysis, it became apparent that to develop a completely general risk model would require an impractical amount of time and resources. The Panel concluded that the greatest utility of the

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methodology, and perhaps the only practical one, lies in answering specific questions with output of a specific pre-determined nature. (Sinha-OEIS) W77-09235

THE EVALUATION OF THE TEST PROCEDURE FOR HAZARDOUS BINARY COMBINATIONS OF MATERIALS IN MARINE TRANSPORTATION. Coast Guard Academy, New London, Conn. A. T. Wehman.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A007 915. Price codes: A05 in paper copy, A01 in microfiche. U.S. Coast Guard Office of Research and Development, Washington, D.C., Final Report No. CG-D-85-75, August 1974. 82 p, 6 fig, 3 append.

Descriptors: *Water pollution control, *Hazards, *Transportation, Chemicals, Chemical reactions, *Testing procedures, Evaluation, Pollutant identification.

Identifiers: *Binary combinations, *Hazardous materials transport.

The proposed test procedure for the evaluation of binary combinations of hazardous materials encountered in marine transportation was checked and verified to be safe, easy to perform, and to give valid and meaningful data. Present data agrees well with that previously published in a Dow report and a recent Norwegian publication. Approximately 100 new binary combinations have been tested, and a reproducibility study was performed. An abbreviated study of variables was undertaken. (Sinha-OEIS) W77-09236

AT SEA TESTING OF A HIGH SEA OIL RECOVERY SYSTEM. Ocean Systems, Inc., Reston, Va.

T. N. Blockwick, R. L. Beach, F. A. March, and L. S. Brown.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A006 938. Price codes: A06 in paper copy, A01 in microfiche. U.S. Coast Guard Headquarters, Washington, D.C., Final Report No. CG-D-57-75, July 1974. 125 p, 32 fig, 2 append. DOT-CG-32, 781-A.

Descriptors: *Water pollution control, *Pollution abatement, *Skimming, Barriers, Resources development, Environment, *California, *Testing.

The at-sea tests of the 2000 gpm Ocean Systems, Inc., Weir-Basin Oil Recovery System (ORS) conducted at Port Hueneme, California, and at Point Conception, California, during the period of 7 August 1973 to 22 August 1973 are summarized. These tests were conducted without oil, with the purpose being to qualify the ORS with respect to strength, stability, operational functions, ease of handling, compatibility with the Coast Guard lightweight oil containment barrier, and compatibility with Coast Guard buoy tenders. The tests showed that the 2000 gpm ORS was compatible with the barrier in both of the deployment configurations tested. Conformance to waves was very good, indicating that a high probability of obtaining high oil recovery efficiencies (Percent oil in the recovered stream) could be expected. Launch and recovery from a buoy tender were successful, although a shorter length for the ORS was indicated to be desirable. Design modifications to minimize fabric wear and to increase the structural adequacy in certain areas are recommended. (Sinha-OEIS) W77-09237

OIL TRANSPORTATION BY TANKERS: AN ANALYSIS OF MARINE POLLUTION AND SAFETY MEASURES.

Office of Technology Assessment, Washington, D.C.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 457. Price codes: A14 in paper copy, A01 in microfiche. Report to Committee on Commerce, U.S. Senate, July 1975. 311 p, 6 fig, 16 tab, 7 attachments.

Descriptors: *Water pollution control, *Oil pollution, *Safety factors, International law, Jurisdiction, Transportation.

Identifiers: *Outer Continental Shelf, *Tankers, Supertankers, *Oil transportation.

A factual background on tankers is presented and a discussion of issues related to the safety of tanker operation and the potential presented by tankers for introducing polluting oil into the marine environment is given. The report focuses on technical alternatives concerning the design, construction and operation of tankers in U.S. waters as these relate to safety and pollution prevention. Supertanker operations are given emphasis when they present particular or unusual problems. (Sinha-OEIS) W77-09238

VULNERABILITY MODEL: A SIMULATION SYSTEM FOR ASSESSING DAMAGE RESULTING FROM MARINE SPILLS.

Enviro Control, Inc., Rockville, Md.

For primary bibliographic entry see Field 5C. W77-09239

A CHEMICAL MONITORING PROGRAM OF THE EXPLOSION PRODUCTS IN UNDERWATER EXPLOSION TESTS.

Naval Surface Weapons Center, White Oak Lab., Silver Spring, Md. M. G. Lai.

Available from the National Technical Information Service, Springfield, VA 22161 as ADA-015 964. Price codes: A04 in paper copy, A01 in microfiche. Technical Report No. NSWC/WOL/TR 75-35, 4 April 1975. 62 p, 10 fig, 5 tab.

Descriptors: *Explosion, Water quality, *Monitoring, Testing, Program, Water pollution control, Pollutant identification.

Identifiers: *Underwater explosions, *Chemical monitoring programs.

A chemical monitoring program of the explosion products in underwater explosion tests is described. The objective of the program is to monitor water quality chemically after underwater explosion tests. The program consists of sampling and preservation of water and sediment samples, separation, concentration, and determination of various explosion products. General concepts, procedures, and equipment needed for each phase of the program are presented. Guidelines and recommendations for the overall program are also given. (Sinha-OEIS) W77-09242

WAMIS ABSTRACTS, NO 2.

Arizona Univ., Tucson. School of Renewable Natural Resources.

For primary bibliographic entry see Field 10C. W77-09256

INFLUENCE OF VEGETATION MANAGEMENT ON YIELD AND QUALITY OF SURFACE RUNOFF.

Texas A and M Univ., College Station. Dept. of Range Science.

For primary bibliographic entry see Field 4C. W77-09266

URBAN WATER RUNOFF AND WATER QUALITY CONTROL.

Virginia Polytechnic Inst. and State Univ., Blacksburg. Water Resources Research Center.

For primary bibliographic entry see Field 5B.

W77-09267

MEASURES FOR REDUCING RETURN FLOWS FROM THE WELLTON-MOHAWK IRRIGATION AND DRAINAGE DISTRICT, ANNUAL REPORT FOR FY 1976.

Bureau of Reclamation, Washington, D.C. Wellton-Mohawk Irrigation and Drainage District. For primary bibliographic entry see Field 4A. W77-09276

THE ROLE OF SYSTEMS ANALYSIS IN THE USE OF AGRICULTURAL WASTES. Manitoba Univ., Winnipeg Dept. of Agricultural Engineering.

D. D. Schulte, and E. J. Kroeker.

Journal of Environmental Quality, Vol 5, No 3, p 221-227, July-September 1976. 4 fig, 21 ref.

Descriptors: *Systems analysis, Model studies, Simulation analysis, Linear programming, Dynamic programming, *Farm wastes.

Identifiers: Agricultural waste management, Interdisciplinary roles.

Agricultural waste management is a multidisciplinary field which has grown in an attempt to solve problems of agricultural by-product utilization and disposal. Development of meaningful solutions to agricultural waste management problems will be much simpler if practitioners and researchers educate one another and together work to solve the different problems of the producer. Many disciplines have already become involved in the problem-solving process; yet, there is a need for a generalist in agricultural waste management who can bridge disciplinary gaps and promote effective cooperation between specialists in various fields of study. Systems analysis can serve a useful purpose in agricultural waste management by providing a focal point for cooperation between disciplines working on various aspects of the problem. Systems analysis has been used to: (I) provide a common structure for comparison a agricultural waste management strategies; (II) identify processes of links within waste-utilization systems which are costly or sensitive to operating conditions; (III) predict effects of external constraints such as government policy, fertilizer taxed, and prices on the effectiveness of waste utilization strategies; (IV) yield information to predict where research funds would be spent most effectively; and (V) assist in technology transfer from researchers to practitioners through the aid of computer-based education models. (Skogerboe-Colorado State) W77-09282

ANTI-POLLUTION BEHAVIOR: A FUNCTION OF PERCEIVED OUTCOME AND LOCUS OF CONTROL.

For primary bibliographic entry see Field 6G. W77-09378

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PREVIEW.

Army Engineer District, Baltimore, Md. (June 1976), 12 p.

Descriptors: *Long term planning, *Waste water treatment, *Water quality, *Short term planning costs, *Federal Water Pollution Control Act, Environmental effects, Sludge disposal, Stormwater, Septic tanks, *Management.

Identifiers: *Binghamton(NY), Wastewater management, *Susquehanna River Basin(NY), Broom County(NY), Tioga County(NY).

The major elements of the 9-volume Binghamton Wastewater Management Study Report are synopsized in this preview. The study's purpose was to prepare an areawide wastewater management plan for Broome and Tioga counties as required by the Federal Water Quality Act Amendments of 1972

(PL 29-500). Short-range plans to the mid-1990's and longrange plans to the year 2020 were developed. Alternatives were systematically compared, but the detailed design data necessary for construction of a specific project were not produced. The study's findings should serve as an aid for evaluating cost-effective and environmentally acceptable methods of water quality control. The study area was divided into two parts, one urban and the other made up of outlying communities. The outlying communities were found to have little impact on water quality. The major problems identified in the study include: the likelihood of population levels exceeding the capacity of existing treatment works; combined sewer overflows during storms that violate water quality standards; uncertainty regarding appropriate sludge disposal methods; and the need to sewer certain suburbs where septic systems are inadequate. The planning framework and citizen participation element are described, as is the plan alternative ultimately selected for implementation. (See also W77-09380 thru W77-09388) (Nessa-NC) W77-09379

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SUMMARY.

Army Engineer District, Baltimore, Md.
June 1976. 97 p, 29 tab, 45 fig.

Descriptors: *Long term planning, *Waste water treatment, *Water quality, *Decision making, *Methodology, *Social participation, *Environmental effects, *Management, Institutions, Social aspects, Costs, Stormwater, Sludge disposal, Septic tanks, Projections, Combined sewers, Social impacts, Federal Water Pollution Control Act.

Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), Wastewater management, Broome County(NY), Tioga County(NY).

This report summarizes the nine volume Binghamton Wastewater Management Study. The study area's climatic, topographic, hydrographic, economic and demographic characteristics are described, as are existing water supply and wastewater management systems. Future wastewater flows are projected. The major problems identified in the study are: the likelihood of population levels exceeding the capacity of existing treatment works; combined sewer overflows during storms that violate water quality standards; uncertainty regarding appropriate sludge disposal methods; and the need to sewer certain suburbs where septic systems are inadequate. The structure and process of citizen participation efforts are detailed. The planning methodology is explained as consisting of three stages in which successive stages are more detailed and consist of fewer alternatives. Stormwater and sludge management options are summarized, their impacts evaluated, and their costs analyzed. A preferred option is selected. The political and institutional arrangements necessary for plan implementation are analyzed according to a set of criteria set forth in the report. Four alternative plans were developed. Each integrated a full range of services. The effect on the environment of each plan is assessed and then the impacts of each plan are compared. The exhaustive comparison process resulted in selection of the most acceptable plan. (See also W77-09379) (Nessa-NC) W77-09380

BINGHAMTON WASTEWATER MANAGEMENT STUDY: BACKGROUND INFORMATION APPENDIX.

Army Engineer District, Baltimore, Md.
June 1976. 187 p, 48 tab, 24 fig, 1 plate.

Descriptors: *Comprehensive planning, *Methodology, *Ecosystems, *Projections, *Water quality, Climatic data, Geology, Hydrologic aspects, Biota, Population, Economics, Water supply, Waste water treatment, Land use, Growth rates, Agriculture, Social aspects.

Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), Wastewater management, Tioga County(NY), Broome County(NY).

This Appendix, part of the 9-volume Binghamton Study, provides information on all phases of the Study. The study area includes those portions of Broome and Tioga Counties drained by the Susquehanna River. The natural characteristics of the region, including climate, geology, water resources and the biotic environment are described, as are the demographic and economic characteristics. Water supply and wastewater management, including industrial systems, are identified and described. Existing water and related land resources problems are identified and assessed. The population projections of various agencies are analyzed for their applicability to this study area. Population projections are broken down by county, municipality and wastewater management areas. Economic projections are presented and analyzed. Desired patterns of growth, land use, environmental quality, agriculture, transportation, housing, and health are discussed with particular reference to the region's overall General Plan. The study provides a range of urban water resource plans that are compatible with Federal, State, and local objectives. The broad Federal policies that guided the study are considered and the Study's specific objectives are presented. At the completion of the Study, alternative plans were compared and evaluated in light of the goals and objectives the planning effort was directed to achieve. (See also W77-09379) (Nessa-NC) W77-09381

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PLAN FORMULATION APPENDIX.

Army Engineer District, Baltimore, Md.
June 1976. 499 p, 105 tab, 48 fig, 6 plates, 143 ref.

Descriptors: *Alternate planning, *Environmental effects, *Waste water treatment, *Water quality, *Management, *Short-term planning, *Long-term planning, Social impact, Economic impact, Design, Institutions, Social participation, Evaluation, Decision making.

Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), Wastewater management, Broome County(NY), Tioga County(NY).

This Appendix is one volume in the nine volume Binghamton Study. The product of the study was the development of alternative long- and short-range plans for the protection and enhancement of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. This Appendix documents all significant events and decisions involved in the formulation, evaluation, and selection of wastewater management plans. As such, it provides a sequential summary of progress throughout the study. The first step in the planning process was to determine Federal, State and local problems, issues, and objectives of wastewater management. To meet these objectives, alternative plans were formulated through an iterative process consisting of systems design, an assessment of all pertinent impacts, and an evaluation of the plan's effectiveness in fulfilling the objectives. The final alternative plans were compared by displaying all significant environmental, economic, and social impacts. Also contained in this Appendix is a summary of the institutional analysis which suggested arrangements for implementation of each of the final plans, and a summary of the public interaction in the planning process. A complete description of the final recommended plan is presented. (See also W77-09379) (Nessa-NC) W77-09382

BINGHAMTON WASTEWATER MANAGEMENT STUDY: COMMENTS APPENDIX.

Army Engineer District, Baltimore, Md.
June 1976. 83 p, 4 fig.

Descriptors: *Social participation, *Waste water treatment, *Water quality, Management, Institutions, Decision making, Long range planning, Short range planning, Federal Water Pollution Control Act.

Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), Wastewater management, Broome County(NY), Tioga County(NY).

The nine volume Binghamton Wastewater Management Study was a joint Federal, State, and local planning effort to develop alternative plans for protection and enhancement of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. The short range and long range plans developed in the study were formulated to complement the existing water quality programs of the State of New York while assisting local communities in achieving the requirements of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). The study focused on water quality and wastewater management problems. It did not concentrate on other water resource needs and problems such as flood control, water supply, or recreation. This Appendix presents a verbatim account of the written review comments of various Federal, State, and local agencies, as well as interested citizens. These comments were taken into account before the final version of the study was written. The comments generally assess the adequacy of the plan in meeting its goals and objectives, and the extent to which the plan complies with relevant State and Federal laws and regulations. (See also W77-09379) (Nessa-NC) W77-09383

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SPECIALTY APPENDIX.

Army Engineer District, Baltimore, Md.
June 1976. 272 p, 54 tab, 26 fig, 12 ref.

Descriptors: *Waste water treatment, *Environmental effects, *Management, *Water quality, CO2s, Recreation, Sludge disposal, Industrial wastes, Non-structural alternatives, Zoning, Building codes, Taxes, Social impact.

Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), *Non-point sources, *Historical impacts, *Wastewater management, Broome County(NY), Tioga County(NY), Prehistorical impacts.

This Appendix is one of nine volumes aimed at developing alternative plans for the protection of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. This Appendix reports on several issues that required special investigation because they covered topical areas broader than the limits of the study areas covered in other volumes. The importance of wastewater management in outlying communities is discussed. The costs and basic steps for planning of a small wastewater treatment system are outlined. Non-point sources of pollution are evaluated. It is concluded that the region does not have any serious wide-ranging non-point source pollution problems. The river-oriented recreational potential associated with the various wastewater management plans is analyzed. The possibility of applying effluent to the land from secondary sewage treatment works is investigated. Industrial wastewater management, including present practices and guidelines for future discharges, are analyzed. Non-structural flow reduction measures such as pricing, zoning, building codes and industrial surcharges are examined. The preliminary costs and effectiveness of these measures are assessed. The historic and prehistorical impacts associated with the various projects proposed in the Binghamton Study are evaluated. (See also W77-09379) (Nessa-NC) W77-09384

BINGHAMTON WASTEWATER MANAGEMENT STUDY: DESIGN AND COST APPENDIX.

Army Engineer District, Baltimore, Md.

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Group 5G—Water Quality Control

June 1976. 639 p, 240 tab, 151 fig, 6 plates, 65 ref.

Descriptors: *Waste water treatment, *Management, *Cost analysis, *Design criteria, *Water quality, Projections, Methodology, Model studies, Sludge disposal, Storm water, Storm runoff, Alternate planning, Interstate rates. Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), Wastewater management, Broome County(NY), Tioga County(NY).

This Appendix is one of nine volumes aimed at developing alternative plans for the protection of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. This Appendix presents the documentation of the engineering analyses which formed the basis of the designs and costs of wastewater management systems. The design criteria discussion summarizes the population and wastewater projections used as the framework for the technical design of alternatives. The analyses performed in the development of these projections are presented. The economic analytical framework deals with cost estimating procedures and elements of the cost-effectiveness analysis. The methodology used in developing the components of the alternative plans is presented. It details the manner in which the various planning criteria were incorporated into the technical design. The development of the water quality model for the Susquehanna River is also presented. The major technological design analyses for wastewater facilities, sludge management and stormwater management are detailed. The design and cost of the four final plans is documented. An in-depth presentation is made of the design, construction schedule, costs, and performance features of each plan. These analyses are based on an interest rate of 6-1/8 percent. (See also W77-09379) (Nessa-NC) W77-09385

BINGHAMTON WASTEWATER MANAGEMENT STUDY: IMPACT ASSESSMENT AND EVALUATION APPENDIX.
Army Engineer District, Baltimore, Md.
June 1976. 306 p, 39 tab, 31 fig.

Descriptors: *Waste water treatment, *Baseline studies, *Environmental effects, *Water quality, *Management, Alternate planning, Social impact, Economic impact, Methodology, Planning. Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), *National Environmental Policy Act(1969), Wastewater management, Broome County(NY), Tioga County(NY).

This Appendix is one of nine volumes aimed at developing alternative plans for the protection and enhancement of water quality and associated resources of the Susquehanna River Basin within Broome and Tioga Counties, New York. This Appendix is intended to fulfill the requirements of the National Environmental Policy Act. The impact assessment was accomplished by a comparison of expected effects associated with a particular alternative to the expected conditions in the study area in the absence of any wastewater management plan. This no action alternative assumed that no further wastewater management decisions would be made in the study area except those already budgeted. This methodology provided a baseline condition against which the alternative plans were compared. In this way, the impacts of an alternative or plan were identified as those effects which differed in some way from the conditions associated with the future baseline. These differences were then either qualitatively or quantitatively measured and their location and timing were identified. Evaluation was accomplished from interpretation of these impacts and comparison of the impacts between alternatives. The degree of beneficial or adverse effects to the environmental and social setting was considered in relation to the baseline and other alternatives. (See also W77-09379) (Nessa-NC) W77-09386

BINGHAMTON WASTEWATER MANAGEMENT STUDY: INSTITUTIONAL ANALYSIS APPENDIX.
Army Engineer District, Baltimore, Md.
June 1976. 239 p, 50 tab, 22 fig.

Descriptors: *Institutional constraints, *Political constraints, *Social aspects, *Waste water treatment, *Water quality, Administration, Management, Alternate planning, Legal aspects, Governments, Planning. Identifiers: *Binghamton(NY), *Susquehanna River Basin(NY), Wastewater management, Broome County(NY), Tioga County(NY).

This volume is one of nine in the Binghamton Study, and presents a description of Federal and State interests in wastewater management. An institution is defined as a formal or informal organization which uses certain administrative, political, and social processes to implement and control wastewater management systems. The Study's purpose is to analyze the existing institutional arrangements for wastewater management in Broome and Tioga Counties, New York, and to assess their capability for implementing recommended technical plans. The Study is limited to existing institutions concerned with water supply and wastewater management. Where shortcomings in the existing institutional arrangements are identified, the Study either suggests ways in which the institutions can be modified, or it suggests new institutional arrangements to provide the needed direction. This report is an information document rather than a decision document. Its objective is to provide a base of information as well as to suggest means which may be utilized to evaluate institutional forms. The Study examines the ability of existing institutions to implement the recommended alternative plans. The plans are then evaluated when various additional management schemes are involved. The relationship of a plan to the Federal planning, design, and construction grant procedures administered by the Environmental Protection Agency is detailed. (See also W77-09379) (Nessa-NC) W77-09387

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PUBLIC INVOLVEMENT APPENDIX.
Army Engineer District, Baltimore, Md.
June 1976. 88 p, 7 tab, 15 fig, 14 ref.

Descriptors: *Decision making, *Waste water treatment, *Attitudes, *Social participation, Social aspects, Planning, Water quality, Management, Governments, Institutions, Social impacts. Identifiers: *Citizen participation, *Binghamton(NY), *Susquehanna River Basin(NY), Broome County(NY), Tioga County(NY), Wastewater management.

This appendix, one of 9 volumes reporting on the Study, describes the public involvement element of the Study. The public was defined as any person or agency outside the Corps of Engineers. The purpose of the public involvement program was: to promote full public understanding of the manner and means by which water resource problems and needs were investigated and solutions proposed; to keep the public fully informed regarding the status and progress of the Study and the results and implications of planning activities; and to solicit from the public their opinions and perceptions of problems, issues, concerns, and needs, and their preferences regarding water resource use and plan development, and any other information and assistance relevant to the planning process. The public involvement structure is explained, including the purpose and rationale behind the several advisory committees. The Federal, State, and local agencies involved in the study are identified, as are their water resource programs. The sequence of events occurring during the study are identified, and the important decisions made at public meetings and advisory

committee sessions are documented. Written material presented at public meetings and during the course of the study is presented. The public involvement program is analyzed, and recommendations for improvements are made. (See also W77-09379) (Nessa-NC) W77-09388

DAIRY MANURE CAN BE USED SAFELY,
California Univ., Davis.
J. L. Meyer, R. S. Rauschkolb, and E. H. Olson.
California Agriculture, V. 30, No 11, p 10-11, Nov 1976. 1 fig.

Descriptors: Waste storage, *Water pollution, Groundwater, Salts, Nutrients, Leaching, Liquid wastes, Solid wastes, *Farm wastes. Identifiers: *Dairy manure, Waste management, Land application, Nitrogen release.

University of California research has established that potential environmental problems in fertilizing croplands with dairy manure can be avoided with proper management. Recent University of California research has shown: (1) the kinds and amounts of salts and plant nutrients in dairy manure, (2) what happens to salts and plant nutrients during storage in manure piles and manure storage ponds, and (3) the amount of salts seeping downward below the soil surface in fields heavily treated with manure. In a continuous cropping system, providing enough nitrogen for satisfactory yield without excessively concentrating salts (which may pollute groundwater and surface waters) depends upon: methods of handling, storing, and applying manure; rate of application; and the amount and rate of nitrogen release in the soil. Taking these factors into account, different management systems are used for dry manure and holding pond manure. For dry manure, once the nitrogen percentage is established (either through laboratory analysis or through an assumed percentage), average expected rates of nitrogen release - called 'decay series' - may be used to determine what annual applications are needed to release the nitrogen to the soil on a year to year basis. The 'decay series' means that, with continued annual applications to the same land, a smaller amount of added manure is needed each year to provide the same amount of available nitrogen in the soil. For liquid manure, equations are given for calculating the amount of manure in storage and the number of acres on which one pondful of liquid manure can be spread each year. (Merryman-East Central) W77-09389

CONTROL OF WATER POLLUTION FROM CROPLAND: VOLUME II--AN OVERVIEW.
Agricultural Research Service, Washington, D.C.
Prepared as a joint publication of Office of Research and Development, EPA, and Agricultural Research Service, USDA. June, 1976, 187 p. 51 fig, 35 tab, 612 ref.

Descriptors: *Agricultural runoff, *Water pollution sources, Sedimentation, Erosion, Nutrients, Pesticides, Economics, Pollutant identification, *Pollution abatement, *Farm wastes. Identifiers: Cropland management.

Engineering and agronomic techniques to control sediment, nutrient, and pesticide losses from cropland are identified, described, and evaluated. Methodology is developed to enable a user to identify the potential sources of pollutants, select a list of appropriate demonstrated controls, and perform economic analyses for final selection of controls. The basic principles on which control of specific pollutants is founded are reviewed, supplementary information is provided, and some of the documentation used in Volume I is presented. (Volume I (Report No. EPA-600/2-75-026a) is available from NTIS as report no. PB-249 517). (See W77-06097) (East Central) W77-09390

WATER MANAGEMENT ASPECTS OF THE AGRICULTURAL UTILIZATION OF LIQUID MANURE AND PRELIMINARY EXPENDITURE STANDARDS, (IN GERMAN).

Institut fuer Wasserwirtschaft, Berlin (East Germany).
W. Kruger, and W. Hirte.
Wasserwirtschaft-Wassertechnik, V 22, No 6, p 201-204, June, 1972. 6 fig, a tab.

Descriptors: Groundwater, Liquid wastes, Leaching, Bacteria, Nitrates, Phosphates, Separation techniques, Cattle, *Waste water treatment, *Water quality standards, *Water pollution, *Farm wastes.
Identifiers: Field spreading, *East Germany.

Field and laboratory tests on the possible contamination of the groundwater with liquid manure in farmlands are described, and recommendations of the intensity of the use of liquid manure are derived. The germ count in liquid manure may be up to 10 times that in domestic effluent. The reduced germ count in the liquid phase of liquid manure following phase separation indicated that the bulk of the germs is adsorbed by solids organic particles. Correlation between the nitrate content of the leachate and the liquid manure expenditure, especially at per-hectare expenditures corresponding to the manure production by 8 or more steers, was established. The intensity of the use of liquid manure had, however, no effect on the phosphate content of the leachate. The contamination of the leachate is dependent on the nutrient extraction by the plant, thus on the time when the liquid manure is applied, and on the soil type. Hygienic and bacteriological investigations revealed that infections of soil layers deeper than 60 cm with coliform bacteria are exceptional when manure produced by maximum of 8 steers is used per hectare. When the manure from at least 4 steers is used per hectare, it should be applied in fractionated doses over an extended period of time. The use of large amounts of liquid manure at one time may cause serious groundwater contamination, especially during the winter period. (Solid Waste Information Retrieval System)
W77-09391

WATER MANAGEMENT PROBLEMS INVOLVED IN THE TREATMENT AND UTILIZATION OF LIQUID MANURE, (IN GERMAN).

Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 5D.
W77-09392

MANURE HARVESTING PRACTICES: EFFECTS ON WASTE CHARACTERISTICS AND RUNOFF.

Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 5D.
W77-09396

ANIMAL WASTE MANAGEMENT IN THE NORTHERN GREAT PLAINS.

South Dakota State Univ., Brookings. Water Resources Research Inst.
For primary bibliographic entry see Field 5D.
W77-09399

THE EFFECTS OF THERMAL DISCHARGE AND ARTIFICIAL AERATION ON STREAM WATER QUALITY.

Kansas State Univ., Manhattan. Inst. for Systems Design and Optimization.
S. H. Lin, L. T. Fan, and C. L. Hwang.
KWRI Contribution No 124. Reprint of a paper presented at the 5th International Heat Transfer Conference September 3 - September 7, 1974, Tokyo, Japan. p 134-138. 5 fig, 21 ref. OWRT B-030-KAN(9). 14-31-0001-3592.

Descriptors: *Water quality control, Dissolved oxygen, Thermal pollution, *Aeration, Water pollution control, Biochemical oxygen demand, Model studies.

Identifiers: *Thermal discharge, *Artificial aeration, *Stream water quality, *Transient plug-flow model, *Computer simulation and optimization, Power generating plant, Organic waste discharge, Modified Streeter-Phelps equations.

The purpose is to investigate (1) the effect of thermal discharge from power generating plants on stream water quality, and (2) the installation of artificial aerators for water quality control of a stream which receives thermal and organic waste discharges by means of computer simulation and optimization. An energy balance equation is formulated to describe the temperature distribution along the stream which receives thermal discharge. The equation is based on heat transfer mechanisms which include short-wave and long-wave radiation, evaporation, and convective heat transfer. The water quality of a stream, as characterized by variations of DO and BOD concentrations, is represented by modified Streeter-Phelps equations. The temperature dependency of BOD removal coefficient, saturation DO concentrations, time-smoothed photosynthesis minus respiration, and natural reaeration coefficient is considered.
W77-09407

INDUSTRIAL EFFLUENT SURCHARGING: A CASE STUDY OF KITCHENER, ONTARIO.

Toronto Univ. (Ontario). Dept. of Geography.
H. Garai.
Journal Water Pollution Control Federation, Vol 49, No 4, p 539-548, April, 1977. 3 fig, 7 tab, 9 ref.

Descriptors: *Water quality standards, *Water rates, Waste treatment, *Industrial wastes, Discharge(Water), Foods, Water policy, Regulation, Treatment facilities, Suspended solids, Biochemical oxygen demand, Waste water treatment, Costs, *Pollution taxes(Charges).
Identifiers: Meat packing industry, Food processing industry.

The effect of surcharging on the reduction of industrial effluent discharges to the Kitchener, Ontario, waste water treatment plant was investigated. The city has introduced a surcharge for waste discharges with more than 350 mg/liter of suspended solids and 30 mg/liter of BOD. This was based on the amount of discharge and the costs of its treatment. The meat packing and food processing industries produced most of the treatment plant's organic loading. An example of the meat packing plant showed that these charges had little effect. A primary in-plant treatment system had been in operation for several years. During the 1972-73 period, operating costs for the pollution control equipment were \$50,000. Another \$10,000 was paid as surcharge. Without the equipment, charges would be \$110-120,000. Variable costs of pollution control were 0.27% of total annual variable costs. Pollution control capital investment was 2% of the total plant investment. The surcharge was a minute portion of plant costs and has not been an incentive to further effluent improvements. Data collected for all industries indicated that there was no relationship between the surcharge and effluent quantity or quality. BOD and suspended solids values could be reduced below surcharge levels by increasing effluent volumes. The use of clean cooling water to dilute effluents was prohibited by water costs and a sewer rebate scheme. Several questions of cost equity between industrial plants were considered. A new charging scheme which was not considered negative to the goals of discharge reduction was developed. (Collins-FIRL)
W77-09413

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY.

DUSTRY. VOLUME 1. EXECUTIVE SUMMARY.

Sobotka and Co., Inc., Stamford, Conn.
D. Hart, S. Sobotka, and W. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 759. Price codes: A03 in paper copy, A01 in microfiche. Report No. EPA-230/3-76-004-1, April 1976. 37 p. 1 fig.

Descriptors: *Pollution abatement, *Oil industry, *Air pollution, *Water quality standards, *Economic impact, Regulation, Prices, Annual costs, Investment, Economics, Capital mobility, Analysis.
Identifiers: *Oil refining industry.

Petroleum industry physical plant expansions in the U.S. petroleum refining industry brought about by EPA regulations on air emissions, water effluent standards and product quality (lead in gasoline and residual fuel oil desulfurization) during the nine-year period 1974-1983 will require capital investments of 1.1 billion dollars to meet these standards. Annual costs, including capital charges, will be about 0.5 billion dollars, all of which will be recovered by price increases averaging about one cent per gallon of product manufactured. This same study, which undertook to project the economic impact of new EPA regulations, forecasts that refinery capacity that existed in 1973 will be required to invest 4.8 billion dollars to meet the regulations. Annual cost to these plants will increase by about 1.4 billion dollars. However, price change associated with the EPA regulations for refinery expansion will, by 1983, increase the sales revenue of existing-in-1973 capacity by 2.0 billion dollars. This net improvement in cash flow reflects the large investment to meet EPA's regulations already made in existing refineries, most of which is not now being recovered. (See also W77-09452 and W77-09453) (Harris-Wisconsin).
W77-09451

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PET. REFINING IND. VOL. 2. PTS 1 AND 2. IND. DESCRIPTION AND TECH. ANALYSIS.

Sobotka and Co., Inc., Stamford, Conn.
D. Hart, S. Sobotka, and W. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 760. Price codes: A10 in paper copy, A01 in microfiche. Report No. EPA-230/3-76-004-2, April 1976. 193 p. 7 fig., 40 tab., 64 ref., 1 append. EPA 68-01-2830.

Descriptors: *Pollution abatement, *Oil industry, *Air pollution, *Water quality standards, *Economic impact, Regulation, Prices, Annual costs, Investment, Capital mobility, Demand, Supply, Technology, Competitive prices.
Identifiers: *Oil refining industry.

The economic impacts on the U.S. petroleum industry brought about by EPA regulations on air emissions, water effluent standards and product quality (lead in gasoline and residual fuel oil desulfurization) during the nine-year period 1974-1983 will be slight. This study finding is posited on the assumptions that (1) price controls will lapse according to the currently-legislated schedule and that (2) consistent with current policy, continued tariff protection adequate to insure the growth of petroleum product consumption will be furnished to domestic refineries. In this description and technical analysis section of a three-volume study, petroleum industry demand and supply factors are analyzed, with details given for products, the market and distributing system, government influences on the market, industry operations, financial structures and trends, refinery technology and technological trends, industry utilization rates, and competition. An executive summary of the study and an economic impact analysis are treated in separate volumes. (See also W77-04451 and W77-09453) (Harris-Wisconsin).
W77-09452

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOL. 3, PT. 3. ECONOMIC IMPACT ANALYSIS.

Sobotka and Co., Inc., Stamford, Conn.
D. Hart, S. Sobotka, and W. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 761.
Price codes: A10 in paper copy, A01 in microfiche.
Report No. EPA-230/3-76-004-3, April 1976. 207 p.
43 tab., 3 append. EPA 68-01-1830.

Descriptors: *Oil industry, *Pollution abatement, *Air pollution, *Water quality standards, *Economic impact, Regulation, Prices, Annual costs, Investment, Capital mobility, Model studies, Simulation analysis, Forecasting, Economic justification, Effluents.
Identifiers: *Oil refining industry, Economic sensitivity analysis.

Only slight economic impacts to the U.S. petroleum industry will be brought about by EPA regulations on air emissions, water effluent standards and product quality (lead in gasoline and residual fuel oil desulfurization) during the nine-year period from 1974-1983; but this finding assumes that price controls will lapse according to the currently-legislated schedule and that, consistent with current policy, continued tariff protection adequate to insure growth of petroleum product consumption will be furnished to domestic refineries. In this economic impact analysis section of a three-volume study, methodology and data are given for five subtopics: (1) price effects of EPA regulations (including description of alternative models for application of regulations and non-application); (2) impact on sales and output of refineries; (3) aggregate industry impacts; (4) differential impacts due to refinery size and configuration; and (5) sensitivity analyses. An executive summary of the study and an industrial description and technical analysis are treated in the first two volumes. (See also W77-09451 and W77-09452) (Harris-Wisconsin).
W77-09453

ENVIRONMENTAL CHANGES IN LAKE ERIE AND THEIR FUTURE IMPACT ON LAKE RESOURCES.

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-09454

RESTORING THE WILLAMETTE RIVER: COSTS AND IMPACTS OF WATER QUALITY CONTROL.

Oregon State Univ., Corvallis.
E. S. Huff, P. C. Klingeman, H. H. Stoevener, and H. F. Horton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 907.
Price codes: A08 in paper copy, A01 in microfiche.
Socioeconomic Environmental Studies Series EPA-600/5-76-005, September 1976. 174 p. 24 fig., 27 tab., 97 ref., 3 append. IBA030, EPA 68-01-2671.

Descriptors: *Rivers, *Water pollution treatment, *Water quality control, *Waste water treatment, *Flow augmentation, *Electric power costs, *Oregon, Input-output analysis, Construction costs, Operating costs, Fisheries, Economic impact, Social impact, Recreation, Cost-benefit analysis, Chlorination, Intangible costs, Wildlife, Associated costs.
Identifiers: *River restoration, *Willamette River(Ore).

How Oregon's heavily-polluted Willamette River has been almost totally rehabilitated by flow augmentation and point source waste water treatment is described and documented, with emphasis on the energy costs of the pollution control. Each pollution control strategy employed during the

preceding four decades and the contribution of each technology is documented, giving total and annual costs of construction and operation and maintenance and the total energy consumed by all facilities, including energy costs of constructing and operating dams as well as treatment facilities and control devices. Data are given for construction and operation of municipal collection and treatment systems, industrial waste water treatment facilities, and reservoirs. Input-output econometrics and a methodology for converting dollar costs to direct and total energy requirements were used to deal with construction and operating and maintenance costs. Energy needs for operating water quality control facilities are about 1/10th of 1% of total basin energy utilization; however, substantial energy savings are possible. The history and present status of the fisheries and wildlife of the basin are reviewed in relation to the enhanced water quality of the river. The potential biologic, economic and social impacts of the program are presented along with related adverse effects attributed to the techniques employed in the water quality improvement. (Auen-Wisconsin).
W77-09455

ENVIRONMENTAL POLICY-MAKING IN THE USSR: THE ROLE OF INDUSTRIAL AND ENVIRONMENTAL INTEREST GROUPS.

Mississippi State Univ., State College.
For primary bibliographic entry see Field 6E.
W77-09456

THE ECONOMIC IMPACT OF ENVIRONMENTAL PROGRAMS.

Council on Environmental Quality, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-09457

POTENTIAL ENVIRONMENTAL IMPACTS FROM THE PRODUCTION OF SYNTHETIC FUELS FROM COAL.

Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 5B.
W77-09458

ENVIRONMENTAL IMPACTS FROM OFFSHORE EXPLORATION AND PRODUCTION OF OIL AND GAS.

Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6G.
W77-09460

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE FEDERAL REPUBLIC OF GERMANY.

Organisation for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6E.
W77-09461

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN CANADA.

Organisation for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6E.
W77-09462

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN FRANCE.

Organisation for Economic Co-Operation and Development Paris (France).
For primary bibliographic entry see Field 6E.
W77-09463

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE NETHERLANDS.

Organisation for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6E.
W77-09464

TECHNICAL AND MICROECONOMIC ANALYSIS: ARSENIC AND ITS COMPOUNDS.

Versar, Inc., Springfield, Va.
For primary bibliographic entry see Field 5B.
W77-09465

ECONOMIC ASSESSMENT OF PROPOSED TOXIC POLLUTANT EFFLUENT STANDARDS FOR MANUFACTURERS AND FORMULATORS OF ALDRIN/DIELDRIN, DDT, ENDRIN AND TOXAPHENE.

Little (Arthur D.), Inc., Cambridge, Mass.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 678.
Price codes: A04 in paper copy, A01 in microfiche.
Report No. EPA-230/3-76-016, May 1976. 65 p. 18 tab., 3 append. EPA 68-01-1902.

Descriptors: *Economic impact, *Water pollution control, *Pollution abatement, Abatement, *Pesticides, Aldrin, Dieldrin, DDT, Endrin, Federal Water Pollution Control Act, Effluents, Standards, Chemical industry, Waste water treatment.
Identifiers: Toxaphene.

Effluent standards for aldrin/dieldrin, DDT, endrin and toxaphene proposed under Section 307(a) of the Federal Water Pollution Control Act Amendments of 1972 are not expected to create significant adverse economic impacts on prices, sales, profitability, employment or the end use markets for these pesticides. In aggregate, compliance would require additional investment in treatment facilities of \$800,000-\$1 million with annualized total costs of \$500,000-700,000. The impact on prices will be potential increases of no greater than 2.3%. Separate data and analyses are provided for pesticide manufacturers and formulators. For the manufacturers, the economic conclusions were reached following an examination of the additional cost of compliance, together with a general assessment of the supply, demand, and pricing for the products and business condition of the respective firms. For the formulators of the pesticides, the conclusions were based on a survey of 16 companies operating 32 of the 145 plants which currently formulate these chemicals. The assessment includes descriptions of firms, plants and markets for the pesticides, investment and operating costs for the abatement technologies and evaluation of pricing for these products and potential adverse impacts. (Harris-Wisconsin).
W77-09478

METHODOLOGY FOR ASSESSING ENVIRONMENTAL IMPLICATIONS AND TECHNOLOGIES: NONFERROUS METALS INDUSTRIES.

Battelle-Columbus Labs., Columbus, Ohio.
E. S. Bartlett, and R. A. Wood.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 476.
Price codes: A05 in paper copy, A01 in microfiche.
Environmental Protection Technology Series EPA-600/2-76-303, December 1976. 97 p. 1 fig., 9 tab., 2 append. 54, EPA 68-02-1323.

Descriptors: *Environmental effects, *Methodology, *Industries, *Pollutant abatement, Information retrieval, Information exchange, Bibliographies, Reviews, Publications, Metals, Technology.
Identifiers: *Nonferrous metals industry, *Information transfer, Current awareness, Information needs, Technology assessment, Industrial pollution control.

Alternative philosophies and methodologies for information collection, analysis, and presentation were considered, and based upon this review, a system was designed for maintaining current awareness and assessing the environmental implications arising from the technology of the nonferrous metals industry. It is concluded that the basic elements of a preferred methodology to serve the awareness requirements of EPA were: (1) location and input of significant information, (2) selective culling, review, and analysis of input information, and (3) preparation and output of a periodic report of the information in the form of an awareness bulletin. Input information was to be obtained from 60 pertinent periodicals, technical conferences, and cognizant government and industry specialists. Information selection, preview, analysis, and output operation were to be conducted by senior technologist with familiarity with both the industry and information systems operations. Subject taxonomy should be developed in an interactive, evolutionary fashion to continuously serve EPA needs. Awareness bulletin output should be brief but comprehensive and be amenable to a continuous filing system. In-depth topical reports and inquiry answering services were not considered necessary to the basic task. It was estimated that the outlined program could be accomplished with an annual funding of approximately one technical man-year of effort. (Luedtke-Wisconsin). W77-09479

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL.

Ohio State Univ. Research Foundation, Columbus.

K. S. Shumate, E. E. Smith, V. T. Ricca, and G. M. Clark.

Available from the National Technical Information Service as PB-264 185, Price codes: A21 in paper copy, A01 in microfiche. Environmental Protection Technology Series EPA-600/2-76-112, November 1976. 492 p, 71 fig, 40 tab, 67 ref, 4 append. 68-011-0724.

Descriptors: *Mine drainage, *Mine acids, *Pollution abatement, *Model studies, Acid mine water, Coal mines, Strip mines, Mine wastes, Strip mine wastes, Water quality control, Optimization, Decision making, Watersheds(Basins), Computer models, Water pollution treatment, Efficiencies, Resource allocation, Costs.

Identifiers: Deep mines.

A comprehensive simulation model for mine drainage and optimal resource allocation to control mine acid pollution in a watershed is described. The overall model is quite detailed, encompassing a hydrologic model, an acid generation model, two pollutant source models—the deep mine source and the combined refuse pile-strip mine source, a basin model, a cost-effectiveness model, and basin optimization models. Emphasis is on the development of the source models and the optimization models. The source models provide a means of describing and predicting the complex time-dependent acid production phenomena which occur in mining environments. The optimization models, utilizing flow and load data and appropriate cost information, provide a cost optimization algorithm capable of determining the least-cost set of pollution control decisions for an array of acid sources, with the option of either drainage treatment or abatement at each acid source with a specific water quality standard. In addition, it can determine the distribution of pollution control decisions over the total array of acid sources which will result in the most desirable water quality obtainable within a set dollar limit. The model has not yet been fully tested or compared to real systems. (Luedtke-Wisconsin) W77-09481

TOTAL AND HYPOLIMNETIC AERATION OF LAKES IN WISCONSIN.

Wisconsin Dept. of Natural Resources, Madison. T. L. Wirth, D. R. Knauer, and S. A. Smith.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p 1960-1970, 1975. 8 fig, 7 ref.

Descriptors: *Oxygenation, *Hypolimnion, Equipment, *Aeration, *Wisconsin, Air entrainment, Destratification, Density, Seasonal, Oxygen demand.

Identifiers: *Lake rehabilitation, *Mirror Lake(Wis), *Larson Lake(Wis), *Silver Lake(Wis), *Aerators.

A 'Helixor' Hypolimnion aerator was used to eliminate anoxic conditions by means of reoxygenation in three Wisconsin lakes. The main component of the unit is a polyethylene tube with an internal longitudinal plate dividing the tube in half in the form of a helix. Its application and efficiency in hypolimnetic aeration of Silver and Larson Lakes, and hypolimnetic and total aeration of Mirror Lake, during summer, fall and winter are discussed. In lakes that do not mix thoroughly or long enough to satisfy oxygen demands, total compressed air mixing in spring and fall was an easy means of providing the maximum quantity of dissolved oxygen available to withstand oxygen demands during summer and winter periods of stagnation. Hypolimnetic aeration without destratification was feasible during summer stratification. During winter, density gradients are small, so that destratification of most of the water column is certain. Enriching compressed air with pure oxygen providing better flow of water and oxygen transfer than used either alone. Almost all of the oxygen transfer took place in the lower half of the 12.2 m 'Helixor' component of the aerator. (Auen-Wisconsin) W77-09495

NEW MEDIUM FOR ISOLATING IRON-OXIDIZING AND HETEROTROPHIC ACIDOPHILIC BACTERIA FROM ACID MINE DRAINAGE.

Environmental Monitoring and Support Lab., Cincinnati, Ohio.

For primary bibliographic entry see Field 5B.

W77-09511

LAKE DRAWDOWN AS A METHOD OF IMPROVING WATER QUALITY.

Florida Univ., Gainesville.

J. L. Fox, P. L. Brezonk, and M. A. Keirn.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 909, Price codes: A02 in paper copy, A01 in microfiche. Ecological Research Series EPA-600/3-77-005, January 1977. 103 p, 38 fig, 20 tab, 36 ref, 1 append. EPA R-800305.

Descriptors: *Drawdown, Laboratory tests, Feasibility, Eutrophication, *Lakes, Lake sediments, Bottom sediments, Nutrients, Turbidity, Dissolved oxygen, Temperature, Muck soils, Chara, Cattails, *Florida.

Identifiers: *Lake restoration, *Lake Apopka(Fla), Sediment drying, Macrophytes.

Results of pilot scale investigations to determine if radical drawdown at Lake Apopka, Florida, would effectively restore the lake by reducing algal blooms and increasing the population of desirable macrophytes are described. Sediments were dredged from the lake bottom, placed in aquaria, columns, tanks, and pools, dewatered and dried over varying periods, and then refilled. Monitoring of a large number of physical, chemical, and biological parameters before, during, and after sediment drying revealed that drawdown improved subsequent refill water quality. In the muck sediments at Lake Apopka, drying caused significant water loss and shrinkage with minimal loss of organic material. During and following refill, the sediment was colonized by two macrophytes, Typha and Chara. Only minor chemical changes occurred in the muck sediments. Refill water in the pool test simulations had the same or lower nutrient content, lower turbidity, higher dissolved oxygen, lower temperature,

fewer algae, and a more diverse benthic invertebrate population. Based on these laboratory scale investigations, it was concluded that drawdown would be an effective restoration technique for Lake Apopka, but that drawdown was not a cure-all by itself and should be coupled with other measures such as the removal of dried muck from shore areas. (Luedtke-Wisconsin). W77-09516

THE USE OF WETLANDS AS NUTRIENT REMOVAL SYSTEMS.

Virginia Inst. of Marine Science, Gloucester Point. M. E. Bender, and D. L. Correll.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-241 002, Price codes: A02 in paper copy, A01 in microfiche. Report No NSF-RA-E-74-033, June 1974. (Chesapeake Research Consortium Report No 29). 14 p, 4 fig, 1 tab, 3 ref. GI-38973.

Descriptors: *Wetlands, *Nutrient removal, *Marshes, Nitrogen compounds, Phosphorus compounds, Salt marshes, Tidal marshes, *Chesapeake Bay, Cycling nutrients, Nutrients, Sewage treatment.

Two different methodologies were used to investigate the effectiveness of marshes as nutrient removal systems in Chesapeake Bay. The first method employed fertilization or loading experiments in combination with tracers, while the second measured natural flux at two undisturbed study sites. Results showed that regularly flooded tidal marshes should not be considered as sinks for nitrogen or phosphorus forms. Although incoming particulate nitrogen was transformed in the marsh and exported to the estuary as ammonia and dissolved organic nitrogen, there was little, if any, net loss of available nitrogen or phosphorus in the marsh. The highest exports of dissolved inorganic phosphorus and ammonia occurred during the summer. High irregularly flooded salt meadow hay (Spartina patens) marshes appear to have some capacity for phosphorus removal. However, it was estimated that a loading of 29,000 gallons of secondary sewage per day would saturate the capacity of an acre of high marsh in 45 days, and once loaded to the capacity the acre could not be expected to be reused for many years. It is concluded that utilization of marshes of any type as nutrient removal systems is highly questionable. (Luedtke-Wisconsin) W77-09520

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM (FINAL ENVIRONMENTAL STATEMENT).

Bureau of Reclamation, Washington, D.C.

FES 77-15, May 19, 1977, 2 vols. Volume I: Statement and Appendices; Vol II: Public Comment.

Descriptors: *Desalination, *Saline water, *Colorado River Basin, *Water management(Applied), Groundwater, Subsurface waters, Water quality, Rivers, Colorado River, Interstate rivers, Water utilization, Water resources, Water supply, Water supply development, Irrigation, Water distribution(Applied), Agriculture, Colorado, Salinity.

Identifiers: *Environmental impact statement, Colorado River Basin Salinity Control Act.

The Colorado River Basin Salinity Control Act of 1974 provides for the construction and operation of facilities in the Colorado River Basin to control the salinity of the water. The final Environmental Impact Statement (EIS) for the project discusses the effects of the project as proposed and also the effects of alternatives such as retiring the irrigated land or declaring a moratorium on future water resources development in the area. A two-volume document serves as the environmental statement for all authorized and proposed salinity control works in the Colorado River Basin, and specifically for two units pending construction at the time

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of the statement. The major beneficial effect of the full program would be the removal of an estimated 1,589,000 tons of salt from the river system each year, resulting in improved water quality for over 1,000,000 acres of farmland and over 17,000,000 people. The adverse effects would include increased use of energy resources, a water loss from the river system affecting approximately 8500 acres of range lands, and some negative biological and aesthetic impacts at the project sites proper. (Sloan-Florida)
W77-09527

POLLUTION OF LAKE MICHIGAN AND ITS TRIBUTARY BASIN.

Environmental Protection Agency, Washington, D.C. Water Quality Office.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 311. Price codes: A13 in paper copy, A01 in microfiche. Proceedings of Conference, Third Session, March 24-25, 1971, Chicago, Illinois, March 1971, 266 p.

Descriptors: *Lake Michigan, *Thermal pollution, *Water quality standards, Water pollution, Heated water, Governmental interrelations, Nuclear power plants, Water pollution control, Thermal power plants, Water pollution sources, Water temperature, Electric powerplants, Power plants, Michigan, Wisconsin, Illinois, Indiana, Administrative agencies, Water quality, Water pollution. Identifiers: *Environmental Protection Agency(EPA), *National Environmental Policy Act, Waste heat, Once-through cooling, Heat discharges.

The Administrator of the Environmental Protection Agency (EPA) is authorized to call a conference when requested by the governor of a state and when there is reason to believe that pollution subject to abatement under the National Environmental Policy Act (NEPA) is occurring. Such a conference was held for the purpose of discussing pollution in Lake Michigan; this document is the verbatim transcript of the proceedings of the reconvened third session of the conference. The primary topic was the problem of heat discharges and consequent thermal pollution in the Great Lakes. Twenty-six electric power generating facilities use Lake Michigan waters for cooling, and other industrial and municipal sources contribute heat discharge into the lake. The biological effects of this thermal discharge are discussed, as are possible solutions to the problem. Participants to the conference were representatives of federal, state and local environmental agencies; members of Congress; and representatives of conservation groups and concerned industries. (Sloan-Florida)
W77-09528

POLLUTION OF THE INTERSTATE AND INTRASTATE WATERS OF THE UPPER MISSISSIPPI RIVER AND ITS TRIBUTARIES.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 694. Price codes: A15 in paper copy, A01 in microfiche. Proceedings of the Federal Water Pollution Control Administration, February 28, March 1 and 20, 1967. Minneapolis, Minnesota. 313 p, 6 fig.

Descriptors: *Mississippi River Basin, *Minnesota, *Wisconsin, *Waste water treatment, Rivers, Interstate rivers, River systems, Mississippi River, Tributaries, Bodies of water, Water pollution sources, Water pollution control, Abatement, Lake Superior, Abatement, Lake Superior, State government, Governmental interrelations, Watershed management. Identifiers: *Federal Water Pollution Control Act Amendments of 1972, Point sources, Non-point sources, Pre-treatment standards.

When there is reason to believe that pollution of interstate water is occurring, the Federal Water Pollution Control Act (FWPCA) provides that the Secretary of the Interior may call a federal-state

enforcement conference upon the request of the governor of any state. At the request of the governors of Minnesota and Wisconsin, such a conference was held in two sessions, the first in 1964 and second in 1967. The result of the first session was a recommendation that an intensive survey of the Mississippi River be undertaken by state and federal agencies. The purpose of the second session was to evaluate the survey and recommend a program for abatement of the numerous kinds of pollution which the survey had revealed. Classifications and standards for industrial and municipal waste water treatment were discussed, as well as methods for enforcing the standards. The conference report consists of the statements of Governor Knowles of Wisconsin, Senator Nelson of Wisconsin, two officials of the Federal Water Pollution Control Administration, and one official of the Minnesota Water Pollution Control Commission. (Sloan-Florida)
W77-09529

FEDERALISM AND THE DEVELOPMENT OF OUTER CONTINENTAL SHELF MINERAL RESOURCES.

Miami Univ., Fla. School of Law.
For primary bibliographic entry see Field 6E.
W77-09531

SECTION 1424(E) OF THE SAFE WATER DRINKING ACT: AN EFFECTIVE MEASURE AGAINST GROUNDWATER POLLUTION.

J. B. Hemphill.
Environmental Law Reporter, Vol 6, p 50121-27, 1976.

Descriptors: *Surface-groundwater relationships, *Aquifer management, *Groundwater resources, Federal Water Pollution Control Act, Aquifers, Groundwater, Water quality, Groundwater recharge, Water sources, Water supply, Potable water, Water pollution, Aquifer characteristics, Water management(Applied), Grants, Government finance, Legislation, Projects, Water law, Water quality standards. Identifiers: *Federal Water Pollution Control Act Amendments of 1972, *Environmental impact statement, *Groundwater management, *Safe Water Drinking Act.

Groundwater aquifers, an important source of drinking water, received partial regulatory protection under section 1424(e) of the Safe Water Drinking Act. This section enables the Administrator of the Environmental Protection Agency (EPA) upon his own initiative, or upon petition, to make a preliminary determination that an aquifer is in need of protection from contamination. To qualify for this determination it must be shown that an aquifer is the principal drinking water source for the area, and that contamination of the aquifer would create a significant hazard to public health. After preliminary determination has been made, the Administrator must publish it in the Federal Register. After publication, the Administrator may block federal funding commitments to any projects which would contaminate the aquifer. Although section 1424(e) provides the EPA with the tools for protecting some underground water supplies, a significant number of groundwater aquifers are outside of its protective scope because of the sole or principal drinking water source limitation. Another problem is that 1424(e) provides no time requirement for corrective action. In addition, 1424(e) is directed only to sole source aquifers threatened by contamination from federally funded projects. (Petruff-Florida)
W77-09536

ANALYTIC VARIABILITY: IMPLICATIONS FOR PERMIT COMPLIANCE.

P. S. Ward.
Journal Water Pollution Control Federation, Vol 48, No 7, p 1876-80, August 1976.

Descriptors: *Federal Water Pollution Control Act, *Permits, *Analytical techniques, *Water pollution sources, Analysis, Water pollution, Effluents, Flow, Variability, Pollutants, Legal aspects, Legislation, Methodology, Water quality, Biochemical oxygen demand, Oil, Phenols, Chemical oxygen demand, Discharge measurement.

Identifiers: *Federal Water Pollution Control Act Amendments of 1972, *National Pollutant Discharge Elimination System, Analytic precision, Grease, Parameters, Effluent flow.

The attainment of accurate measurements of flow and concentration of the effluent stream is becoming increasingly important as the July 1, 1977 deadline approaches. These measurements are used in determining compliance with the National Pollutant Discharge Elimination System (NPDES) permit program. When issuing permits, parameters such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), phenolic compounds, and oil and grease are commonly used despite the fact that difficulties exist with their analytic precision. The most commonly encountered limitation of the BOD test involves the acclimation of the biological seed. An insufficient acclimation period results in a low estimate of the oxygen demand. In the COD test the precision of the analysis is affected by the types of organic compounds present. Phenolics are measured by the use of the extraction or the direct photometric technique. A graph shows the variability of the two methods. With oil and grease the impediment to accurate measurement is a result of the difficulty of obtaining a representative sample. The measurement of these parameters is also affected by the effluent flow. In determining compliance with NPDES standards, it is apparent that analytical variability must be taken into account. (Petruff-Florida)
W77-09538

NEW OPPORTUNITIES FOR STATE PARTICIPATION IN THE CONTROL OF RADIOACTIVE POLLUTION.

J. R. Fabrizio.
Chicago-Kent Law Review, Vol 52, No 1, p 157-68, 1975.

Descriptors: *Water pollution control, *Radioactive wastes, *Nuclear wastes, *Federal Water Pollution Control Act, Federal jurisdiction, Nuclear energy, Nuclear power plants, State jurisdiction, Legislation, Waste disposal, Legal aspects, State governments, Standards, Pollution abatement, Environmental control. Identifiers: *Federal Water Pollution Control Act Amendments of 1972.

State governments have expressed a strong desire to regulate the environmental aspects of atomic energy production, but have been prevented from assuming any role by the belief that the Atomic Energy Act of 1954 pre-empted the states' power in this area. Even though Congress has the power to preclude the states from exercising any control over atomic waste disposal, it has never expressly done so; rather, the courts have imputed this intent to Congress. The author reviews two developments which may open the door to state regulation. The first is the passage of the 1972 Amendments to the Federal Water Pollution Control Act (FWPCA), which seemingly takes from the Atomic Energy Commission (AEC) and gives to the Environmental Protection Agency (EPA) the responsibility for control of certain radioactive materials; also under the FWPCA, the states are expressly authorized to impose stricter performance standards than the EPA. The second development is the court decision upholding the interpretation that the FWPCA conferred jurisdiction on the EPA to regulate the discharge of radioactive waste materials into navigable waters. The author concludes that there is a small possibility that the states may be allowed to play a role in atomic energy pollution control, but their role

will depend upon further court and Congressional action. (Jones-Florida)
W77-09539

PETROLEUM LEGISLATION IN THE NORTH SEA COUNTRIES

For primary bibliographic entry see Field 6E.
W77-09542

CLEAN AIR EQUALS DIRTY WATER

Los Angeles Dept. of Public Works, Calif.
D. C. Fillman, and R. S. Hori.
Journal of the Environmental Engineering Division (ASCE), Vol 101, No 1, p 87-90 (February 1975). 2 ref.

Descriptors: *Sewage treatment, *Waste water treatment, *Projects, *Growth rates, *Air pollution, Project planning, Air environment, Water pollution sources, Water pollution, Sewage, Waste water (Pollution), Water pollution control, Transportation, Land use, Zoning, Systems analysis, Sewers, Environmental effects, Administrative decisions.
Identifiers: Emissions controls.

Current Clean Water Grant practices may threaten the environment rather than aid it. There is great concern over the sizing of waste treatment facilities based upon the rationalization that this leads to growth, which in turn leads to new sources of air pollution. The Environmental Protection Agency requires all states to review air pollution effects of new development with the rationale that development means more traffic and growth which in turn creates more smog. The solution of some air resource controls has been to delay or actually deny funds for water pollution projects in order to slow down growth. Growth should be controlled by proper zoning and land use, not by denying additional sewer capacity. The deprivation of public services creates a threat to the environment because of a lack of waste treatment facilities. The ultimate responsibility for wastewater facilities lies with the designer, constructor and plant operator, and not the dispenser of funds. The situation calls for a systems-integrated approach rather than singular bureaucratic pursuits. A balancing of transportation controls, emissions controls and wastewater treatment facilities can result in clean water as well as clean air. (Rieck-Florida)
W77-09544

WATER POLLUTION CONTROL FEDERATION SPEAKERS ZERO IN ON POLLUTION CONTROL LAW

C. W. Heckroth.
Water and Waste Engineering, Vol 10, No 12, p 32-35 (December 1973).

Descriptors: *Evaluation, *Federal Water Pollution Control Act, *Water Pollution Control Federation, *Financial feasibility, *Economic feasibility, Industries, Economic impact, Water law, Regulation, Economics, Feasibility, Financing, Organizations, Water pollution control, Legislation, Control, Abatement, Grants, Administrative decisions, Administrative agencies.
Identifiers: *Federal Water Pollution Control Act Amendments of 1972, *Administrative regulations.

The keynote speaker of the 1973 Water Pollution Control Federation (WPCF) Conference urged the federation to get involved in national policy making by offering plausible and constructive amendments to expedite water pollution control. He attacked the economic impracticality of zero discharge, and the potential harm to air and land which this standard implies. He praised the mechanisms for defining best practicable control technology, but urged the Environmental Protection Agency (EPA) to remain flexible. Lack of adequate financing was named as a critical view of the federal imperatives characterizing the missed

deadlines, unrealistic assumptions, poor talent, overwhelming demands, continual adjustments and administrative mishandling as chaotic. He speculated that the EPA will be forced to rely on flexible standards to meet realities and that municipalities and industries will increasingly seek judicial interpretation of administrative decisions to further delaying compliance. Russell Train, EPA Administrator abstained from coming to the law's defense, and urged states to assume authority for issuance of wastewater discharge permits. Ralph Luken of the EPA outlined the Environmental Financing Authority and its power to purchase local bonds which finance the non-federal costs of waste treatment project construction. (Moorhouse-Florida)
W77-09546

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES: JULY-SEPTEMBER 1975

Nuclear Regulatory Commission, Washington, D. C.
For primary bibliographic entry see Field 6E.
W77-09549

BENEFIT-COST ANALYSIS: ITS USE (MISUSE) IN EVALUATING WATER RESOURCE PROJECTS

For primary bibliographic entry see Field 6B.
W77-09550

WHAT ARE WE DOING ABOUT OIL SPILL

M. P. Wilson, Jr.
Maritimes, Vol 20, No 3, p 7-9 (August 1976). 1 photo.

Descriptors: *Oil pollution, *Oil spills, *Cleaning, *Environmental effects, *Dispersion, Water pollution, Drilling, Exploration, Damages, Oily water, Energy, Pipelines, Beaches, Oil wastes, Planning, Research and development, Barriers, Navigable waters, Marshes, Intertidal areas, Water quality control.
Identifiers: *Environmental response team, *National Oil Spill Contingency Plan.

On May 26, 1967, President Johnson directed the Department of the Interior and the Department of Transportation to mobilize the resources of this nation against the pollution of water by spills of oil, or other hazardous substances. At that time, the United States was committed primarily to containment and mechanical clean-up devices. Today the United States leads the world not only in the capability of the various devices, but also in the number of devices situated at various strategic locations throughout the country. Under the National Oil Spill Contingency Plan the parties responsible for an oil spill are also responsible for cleaning it up, with the Coast Guard functioning as a standby in the event that the responsible party does not take appropriate steps. When an oil spill occurs in water, the first reaction is to contain the spill by barriers or oil booms. Once the spill is contained, mechanical skimmers or adsorbents are used to clean up the contained oil. Experience with the use of dispersants on beaches has not been favorable for many reasons. Other methods of treating oil spills such as agents that sink the oil, burn it or biologically degrade it, have been rather ineffective to date. In spite of these efforts, oil spills continue to affect beaches, the intertidal zone, and marshes. There is a long way to go in the area of preventing spills, and find new techniques to mitigate the damage. (Martin-Florida)
W77-09553

EFFLUENT STANDARDS: TRIALS AND TRIBULATIONS

J. T. Sliter.
Journal Water Pollution Control Federation, Vol. 46, No. 2, p. 232-236, February, 1974.

Descriptors: *Federal Water Pollution Control Act, *Administrative decisions, *Regulation, *Administrative agencies, *Waste water, Waste treatment, Waste water (Pollution), Water pollution control, Water pollution sources, Water quality, Water quality standards, Federal government, Pollution abatement.
Identifiers: *FWPCA Amendments of 1972, *Administrative regulations, *Effluent limitations.

The Environmental Protection Agency (EPA) and the Effluent Standards and Water Quality Information Advisory Committee have attempted to develop standards to regulate the type and amount of pollutants that industries will be allowed to discharge into waterways under the 1972 Federal Water Pollution Control Act Amendments. The Committee was established under the Act to provide assistance to EPA but has been involved in several policy clashes with EPA concerning the standards' developmental stage. EPA's strategy entailed development of an industry standard which all plants in that industry would have to meet, while the Committee developed an alternative approach based on a mathematical model involving four variables. Difficulties between EPA and the Committee stem from a difference of opinion concerning the Committee's role. Probably all the standards are not based upon use of model but optimism is expressed for future development of workable effluent standards. (Welch-Florida)
W77-09554

THE NEED FOR A NATIONAL OCEAN PROGRAM AND PLAN

For primary bibliographic entry see Field 6E.
W77-09555

EFFLUENT GUIDELINES AND STANDARDS, PULP, PAPER AND PAPERBOARD POINT SOURCE CATEGORY

Environmental Protection Agency, Washington, D. C.
Federal Register, Vol 42, No 4, p 1398-1426, January 6, 1977.

Descriptors: *Federal Water Pollution Control Act, *Pulp and paper industry, *Waste water treatment, *Water quality standards, *Regulation, Standards, Administrative agencies, Federal government, Industrial wastes, Toxicity, Effluents, Costs, Economic impact, Water quality control, Pollutants, Pollution, Pulp wastes, Wood wastes, Paper pulp wastes, Water pollution sources, Chemical wastes.
Identifiers: *Effluent limitation guidelines, Administrative regulations.

The Environmental Protection Agency (EPA) has established final amendments to the regulations setting guidelines and standards for effluent limitations for the pulp, paper, and paperboard point source category. The EPA has summarized the comments made on the regulations by members of the pulp and paper industry and has responded to the comments. The final regulations contain a number of significant changes from the interim final regulations. Factors considered in formulating the regulations include age and size of plant, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements, and costs. Specific pollutants to be regulated include BOD₅, TSS and pH. Various definitions and sub-category classifications were revised to provide clarity and consistency between sub-category definitions. Costs of both internal and external controls were examined based upon the revised subcategory effluent limitations. The economic impact of the new regulations is not expected to differ from that which was anticipated for the interim final regulations. (Moorhouse-Florida)
W77-09556

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

EFFLUENT GUIDELINES AND STANDARDS, PHOTOGRAPHIC POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
Federal Register, Vol 41, No 136, p 29078-82, July 14, 1976.

Descriptors: *Photography, *Water pollution control, *Regulation, *Water pollution sources, Water quality standards, Films, Water law, Water quality, Wastes, Water pollution, Legal aspects, Pollution abatement, Federal government, Economic impact, Industrial wastes, Industrial plants, Standards, Costs.

Identifiers: *Cyanide, *Silver, *Administrative regulations, *Effluent limitations, Point sources(Pollution), Photographic industry.

The Environmental Protection Agency (EPA) herein reports the interim final form of effluent limitations for any point source discharges resulting from the development or printing of paper, prints, slides, negatives, enlargements, movie film, and other sensitizing materials. Facilities processing less than 150 square meters per day are excluded as the economic impact of compliance would be prohibitive to them. Cost of compliance industry-wide is estimated to be \$1.83 million initially and \$0.43 million annually. Upon analysis of such factors as age and size of plants, raw materials, manufacturing processes, products produced, treatment technology available, energy requirements, and costs, the guidelines for the degree of effluent reduction attainable by application of the best practicable control technology currently available were established. The regulations are addressed solely to the control of total cyanides and silver. The methods used to reduce the harmful oxygen consuming properties of other photographic wastes. Detailed appendices are attached explaining the legal authority for the regulations, the methodology used in their promulgation, and summarizing public participation in their creation. (Moorhouse-Florida)
W77-09557

EFFLUENT GUIDELINES AND STANDARDS, STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
Federal Register, Vol 41, No 60, p 12694-97 March 26, 1976.

Descriptors: *Thermal pollution, *Water cooling, *Heat transfer, *Thermal capacity, Temperature, Thermal properties, Thermal power, Steam, Thermal powerplants, Electric power production, Steam turbines, Water temperature, Lakes, Cooling water, Cooling towers, Industrial water, Thermal stress, Administrative agencies, Federal government, Regulation, Control.
Identifiers: *Administrative regulations.

The Environmental Protection Agency (EPA) has promulgated the Steam Electric Power Generating Point Source Category regulations. The regulations provide that new sources may not discharge heat to navigable waters unless such discharge is from cooling towers or off-stream cooling ponds. The EPA now believes that cooling lakes may, in some cases, be preferable to other methods of providing control of thermal discharges. Man-made lakes for thermal cooling will be permitted where such lakes are deemed the best available demonstrated technology. The regulations impose a three criteria test to be applied by the regional administrator in order to make this determination. First, a study must be made to assure that both the construction and operation of the impoundment or body of water will not adversely affect municipal water supplies, shellfish beds, fishery areas, wildlife, or recreational areas. Secondly, a determination must be made that the discharge from the water body contains no more than 2% of the water condenser heat passed to the cooling water body.

Finally, a recirculation requirement will be imposed establishing a flow restriction limiting the total discharges from the water body, on a long-term average annual basis, to no more than 100 cubic feet per second per thousand megawatt generating capacity of the facility. (Moorhouse-Florida)
W77-09558

EFFLUENT GUIDELINES AND STANDARDS, THE ORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.
Federal Register, Vol 41, No 2, p 902-13, January 5, 1976.

Descriptors: *Organic compounds, *Chemical industry, *Waste water treatment, *Effluents, Federal Water Pollution Control Act, Water quality standards, Water pollution sources, Chemicals, Chemical wastes, Federal government, Administrative agencies, Water pollution control, Industrial wastes, Industrial water, Water quality control, Industrial plants, Industrial production, Economic impact, Cost-benefit analysis, Public health, Costs.

Identifiers: *Administrative regulations, *Effluent limitations, *Effluent guidelines, *Point sources(Pollution).

The Environmental Protection Agency (EPA) has amended its regulations setting guidelines and standards for effluent limitations for the major organic products segment of the organic chemicals manufacturing point source category. The sub-categories covered by the regulation include nonaqueous processes; processes with process water contact only as steam diluent, quench or vent gas absorbent; aqueous liquid-phase reaction systems; and, batch and semi-continuous processes. Twenty-seven products with a description of the process for each product are included in the regulation. Effluent limitations are established for the effluent characteristics of BOD₅, TSS, pH, cyanide and copper. The EPA has summarized the comments made on the regulations by members of organic chemical manufacturing industry and has responded thereto. (Moorhouse-Florida)
W77-09559

PERMIT PROGRAM REGULATIONS FOR AGRICULTURAL ACTIVITIES, (NPDES), (PROPOSED).

Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 6E.
W77-09560

OIL IN NEPTUNE'S KINGDOM: PROBLEMS AND RESPONSES TO CONTAIN ENVIRONMENTAL DEGRADATION OF THE OCEANS BY OIL POLLUTION.

Cummins Engine Co., Inc., Columbus, Ind.
S. S. Kalsi.
Environmental Affairs, Vol 3, No 1, p 79-108 (Winter 1974).

Descriptors: *International waters, *Oil pollution, *Treaties, *Oceans, *Canada, *International commissions, International law, Political aspects, Political constraints, Pollution abatement, Pollutants, Water pollution, Water pollution control, Water pollution sources, Oil spills, Oil wastes, Oil wells, Wastes, Water, Offshore platforms.
Identifiers: *Hazardous substances(Pollution).

Oil is one of the worst pollutants of the oceans because it is poisonous to marine life. Tankers, offshore oil drilling, and oil pumping by ships are significant sources of oil pollution. Another serious problem with oil pollution is its transnational character. International treaties relating to the control of oil pollution of the high seas have proven to be ineffective due to lack of enforce-

ment and insufficient penalties. To fill the legal vacuum left by weak international treaties, Canada, in 1970, took unprecedented unilateral action in expanding its national contiguous zones for control of oil pollution. Until effective treaties are negotiated, other coastal states should also expand their contiguous zone jurisdictions. The author discusses principles of prevention of oil pollution including such preventive measures as onshore oil residue reception facilities, ship construction standards, and navigation regulation, and such restorative measures as clean-up after spill. Eventually, all intentional oil discharges should be prohibited and strict liability should be imposed for all oil spills. (Joseph-Florida)
W77-09562

MORSHEAD V CALIFORNIA REGIONAL WATER (WATER QUALITY STANDARDS UPHOLD AS A VALID EXERCISE OF POLICE POWER).

For primary bibliographic entry see Field 6E.
W77-09564

PITMAN V WASHINGTON SUBURBAN SANITARY COMMISSION (ENVIRONMENTAL EFFECTS REPORTS ONLY REQUIRED FOR STATE ACTIONS).

For primary bibliographic entry see Field 6E.
W77-09573

LANSO, INC. V DEPARTMENT OF ENVIRONMENTAL PROTECTION (INSUROR'S LIABILITY FOR COST OF CLEAN UP OF OIL SPILLS).

For primary bibliographic entry see Field 6E.
W77-09574

ALTERATION OF CHANNEL OF STREAMS (PERMIT SYSTEM).

For primary bibliographic entry see Field 6E.
W77-09575

TANNERS' COUNCIL OF AMERICA V TRAIN (REVIEW OF EFFLUENT LIMITATIONS FOR TANNING INDUSTRY).

For primary bibliographic entry see Field 6E.
W77-09578

CPC INTERNATIONAL, INC V TRAIN (REVIEW OF EFFLUENT LIMITATIONS FOR THE CORN WET MILLING INDUSTRY).

For primary bibliographic entry see Field 6E.
W77-09579

DIGESTED SLUDGE: DELINEATION AND MODELING FOR OCEAN DISPOSAL,

California Inst. of Tech., Pasadena.
For primary bibliographic entry see Field 5E.
W77-09596

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE UTILITY OF COMPUTERS IN LANDSCAPE PLANNING, THE SELECTION AND APPLICATION OF A COMPUTER MAPPING AND ASSESSMENT SYSTEM FOR THE METROPOLITAN LANDSCAPE MODEL (METLAND).

Massachusetts Univ., Amherst. Dept. of Landscape Architecture and Regional Planning.
K. H. Ferris, and J. Gy. Fabos.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 319.
Price codes: A06 in paper copy, A01 in microfiche.
Research Bulletin No 617, December 1974. 116 p.

37 fig, 5 tab, 57 ref, 4 append. Mass. Agricultural Experimental Station College of Food and Natural Resources - UMass at Amherst. OWRT B-029-MASS(4), 14-31-0001-3897.

Descriptors: *Planning, *Landscaping, Cities, Mapping, Computers, *Model studies, Computer models, *Landuse, Evaluation.

Identifiers: *Computer mapping, *METLAND model.

This study was undertaken to select a computer mapping and assessment system, using the image digitizer, for incorporation into the METLAND model. The specific study objective was to modify or adopt an already developed system (consonant with METLAND study needs, requirements and strategy) to the METLAND study. The procedure of the research was: (1) detail the general and specific METLAND objectives and methodology in order to establish the framework within which such a choice might be made; (2) conduct an analysis of the state of the art of geographic information systems and computer mapping systems to ascertain their capabilities; (3) select, and justify the selection or modification of, one of these systems; and (4) apply the system to a preselect METLAND variable to test its capabilities. (The water supply variable was selected.) Study results indicated that the Computer Mapping for Land Use Planning (COMLUP) system was tailored to METLAND needs with only slight modification. COMLUP could reproduce (in line format) detailed source map virtually identical to the originals. In addition the capability for mapped and plotted overlays was established even though graphic evidence of this finding was not included in this publication. COMLUP prove satisfactory both in terms of the objectives of this research and the METLAND study in general.

W77-09151

ENVIRONMENTAL MODELING AND SIMULATION, PROCEEDINGS OF THE CONFERENCE ON.

Environmental Protection Agency, Washington, D. C. Office of Research and Development. For primary bibliographic entry see Field 5B.

W77-09154

FUTURE ENVIRONMENTAL QUALITY MANAGEMENT USING MODELS,

Environmental Research Lab., Athens, Ga. For primary bibliographic entry see Field 5G.

W77-09155

A SYSTEMATIC APPROACH TO REGIONAL WATER QUALITY PLANNING,

Systems Control, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 5G.

W77-09156

RIBAM, A GENERALIZED MODEL FOR RIVER BASIN WATER QUALITY MANAGEMENT PLANNING,

Raytheon Co., Portsmouth, R.I. Environmental Systems Analysis. For primary bibliographic entry see Field 5G.

W77-09158

PLANNING MODELS FOR NON-POINT RUNOFF ASSESSMENT,

Environmental Protection Agency, Athens, Ga. Ambient Monitoring Section. For primary bibliographic entry see Field 5B.

W77-09162

GENERALIZED METHOD FOR EVALUATING URBAN STORM WATER QUALITY MANAGEMENT STORAGE/TREATMENT ALTERNATIVES,

Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.

For primary bibliographic entry see Field 5D. W77-09188

EVALUATION AND SELECTION OF WATER QUALITY MODELS: A PLANNER'S GUIDE,

Systems Control, Inc., Palo Alto, Calif. For primary bibliographic entry see Field 5B.

W77-09191

A RESOURCE ALLOCATION MODEL FOR THE EVALUATION OF ALTERNATIVES IN SECTION 208 PLANNING CONSIDERING ENVIRONMENTAL, SOCIAL AND ECONOMIC EFFECTS,

Grumman Ecosystems Corp., Bethpage, N.Y. For primary bibliographic entry see Field 5G.

W77-09192

REGIONAL RESIDUALS-ENVIRONMENTAL QUALITY MANAGEMENT MODELS: APPLICATION TO EPA'S REGIONAL MANAGEMENT PROGRAMS,

Resources for the Future, Washington, D. C. Quality of the Environment Program. For primary bibliographic entry see Field 5G.

W77-09193

COMPUTER SIMULATION OF LONG-TERM SECONDARY IMPACTS OF WATER AND WASTEWATER PROJECTS,

Boyle Engineering Corp., Newport Beach, Calif. Environmental Studies. For primary bibliographic entry see Field 5B.

W77-09195

ECONOMIC FORECASTING FOR VIRGINIA'S WATER RESOURCE PROGRAMS,

Virginia State Water Control Board, Richmond. For primary bibliographic entry see Field 6B.

W77-09197

SIMULATION AND MATHEMATICAL MODELING OF WATER SUPPLY SYSTEMS - STATE-OF-THE-ART,

Michigan Univ., Ann Arbor. School of Public Health. For primary bibliographic entry see Field 4A.

W77-09200

CAPACITY EXPANSION FOR MUNICIPAL WATER AND WASTEWATER SERVICES: INCORPORATION OF UNCERTAINTY,

Curran Associates, Inc., Northampton, Mass. For primary bibliographic entry see Field 5D.

W77-09201

NEW MODELS FOR OPTIMAL SEWER SYSTEM DESIGN,

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering. For primary bibliographic entry see Field 5D.

W77-09205

WATER SUPPLY SYSTEMS PLANNING, MANAGEMENT AND COMMUNICATION THROUGH AN INTERACTIVE RIVER BASIN SIMULATION MODEL,

Ohio River Div. Labs., Mariemont. For primary bibliographic entry see Field 6B.

W77-09212

FUTURE DIRECTIONS IN URBAN WATER MODELING,

Water Resources Engineers, Inc., Walnut Creek, Calif. For primary bibliographic entry see Field 5D.

W77-09213

SIMULTANEOUS INVESTMENT-ALLOCATION: AN APPLICATION OF GENERALIZED BENDERS DECOMPOSITION TO WATER PLANNING,

Texas Univ., at Austin. Center for Cybernetic Studies. R. D. Armstrong, and C. E. Willis. Available from the National Technical Information Service, Springfield, VA 22161 as ADA-017 937. Price codes: A02 in paper copy, A01 in microfiche. Research Report CCS 243, August 1975. 22 p. 2 tab., 22 ref. NR 047-021, ONR NO0014-75-C-0616;0569.

Descriptors: *Planning, *Investment, *Cost allocation, *Decision making, Economics, Mathematical models, Model studies, Computer models, Computer programs, Water allocation(Policy), Water distribution(Policy), Pricing water rates, California, *Water resources development. Identifiers: *Benders decomposition analysis, Integer computer programming, Quadratic computer programming.

Models are described for water resources planning in which formal decision frameworks are simultaneously applied to the consideration of both water resource investment decisions for multiple supply sources and allocation (pricing) of the resultant water supplies over regions and uses. Previous works had addressed these problems separately, or had treated investment and allocation components simultaneously only at a conceptual level. The present study utilizes a model framework to demonstrate the method for water resources planning in San Luis Obispo and Santa Barbara counties in California; this region presents a demand structure for residential, commercial, industrial and agricultural uses of supplemental water supplies with alternatives for costs of constructing an aqueduct to import water from another part of the state, for constructing a seawater desalting plant, or for various local reservoir possibilities. The quadratic discontinuous mathematical programming problems resulting from the use of such models are solved optimally by using generalized Benders decomposition, a partitioning procedure for solving mixed-variable programming problems. (Harris-Wisconsin).

W77-09466

6B. Evaluation Process

THE ENVIRONMENTAL IMPULSE AND ITS COMPETITORS: ATTITUDES, INTERESTS, AND INSTITUTIONS AT LAKE TAHOE,

California Univ., Davis. Dept. of Political Science. E. Costantini. Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 359. Price codes: A02 in paper copy, A01 in microfiche. California Water Resources Center, Report No. 32, April 1975, 17 p. (California Water Resources Center Project UCAL-WRC-W-299) OWRT A-037-CAL(4).

Descriptors: *Environmental effects, *Decision making, *Constraints, *Political constraints, *Institutions, Psychological aspects, *Attitudes, *California, Environment, Lakes. Identifiers: *Lake Tahoe(Calif).

A summarized and updated version is presented of a Technical Completion Report (See W74-06843). Inevitably, the question of what constitutes unacceptable environmental conditions is a political one: Environmental policy cannot be an irresistible, simple unchallenged response to empirical or scientific fact alone. No matter how weighty the evidence of degradation may be, the environmental impulse inevitably confronts competing, perhaps stronger, impulses. As a consequence, what constitutes unacceptable environmental conditions and what to do about them are political questions, for it is in the political process that disagreement over significant social values and con-

Field 6—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

fluctuating interests finds expression and seeks some form of resolution. The relationship between political institutions and institution building at Tahoe on the one hand, and the environmental impulse and its competitors on the other is explored. (Snyder-California, Davis)
W77-09145

THE UTILITY OF COMPUTERS IN LANDSCAPE PLANNING, THE SELECTION AND APPLICATION OF A COMPUTER MAPPING AND ASSESSMENT SYSTEM FOR THE METROPOLITAN LANDSCAPE MODEL (METLAND),
Massachusetts Univ., Amherst. Dept. of Landscape Architecture and Regional Planning.
For primary bibliographic entry see Field 6A.
W77-09151

FUTURE ENVIRONMENTAL QUALITY MANAGEMENT USING MODELS,
Environmental Research Lab., Athens, Ga.
For primary bibliographic entry see Field 5G.
W77-09155

A SYSTEMATIC APPROACH TO REGIONAL WATER QUALITY PLANNING,
Systems Control, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W77-09156

RIBAM, A GENERALIZED MODEL FOR RIVER BASIN WATER QUALITY MANAGEMENT PLANNING,
Raytheon Co., Portsmouth, R.I. Environmental Systems Analysis.
For primary bibliographic entry see Field 5G.
W77-09158

PLANNING IMPLICATIONS OF DISSOLVED OXYGEN DEPLETION IN THE WILAMETTE RIVER, OREGON,
Geological Survey, Portland, Oreg.
For primary bibliographic entry see Field 5B.
W77-09160

A WATER RESIDUALS INVENTORY FOR NATIONAL POLICY ANALYSIS,
National Academy of Sciences, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-09164

COST-EFFECTIVE ANALYSIS OF WASTE LOAD ALLOCATIONS,
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5B.
W77-09167

JOINT USE OF SWMM AND STORM MODELS FOR PLANNING URBAN SEWER SYSTEMS,
Clinton Bogert Associates, Fort Lee, N.J.
For primary bibliographic entry see Field 5D.
W77-09172

WATER QUALITY MODELING IN TEXAS,
Texas Water Quality Board, Austin. Engineering Analysis and Modeling Section.
For primary bibliographic entry see Field 5B.
W77-09181

EVALUATION AND SELECTION OF WATER QUALITY MODELS: A PLANNER'S GUIDE,
Systems Control, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5B.
W77-09191

ENVIRONMENTAL, FISCAL AND SOCIO-ECONOMIC IMPACT OF LAND USE POLICIES: TOWARD AN INTERACTIVE ANALYSIS,
Meta Systems Inc., Cambridge, Mass.
J. Kuhner, M. Shapiro, and R. J. deLucia.

In: Proceedings of the EPA Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 453-457, July 1976. 3 fig, 4 tab, 7 ref.

Descriptors: *Water quality control, *Simulation analysis, *Computer models, *Land use, *Economic impact, *Social impact, Storm water, Runoff, Evaluation, Sewers, Treatment facilities, Costs, Systems analysis.

Identifiers: Environmental impact, Fiscal impact.

Effective implementation of recent environmental quality legislation requires planning tools which give quantitative estimates of the various impacts of land use and environmental controls. The literature reveals that no adequate comprehensive tools are available. However, three models have been developed by Meta Systems Inc., for EPA in a recent study. Via simulation, the models evaluate: (1) the impact of urban nonpoint sources on water quality—stormwater runoff model; (2) sewer and treatment plant capacity—capacity evaluation model; and (3) the distribution of costs borne by different groups in response to new development and environmental controls—cost and fiscal impact model. In conclusion, there is a need to determine more specifically the relationship between land use and environmental quality; study results indicate the effectiveness of the three models presented in helping to clarify this relationship. (See also W77-09154) (Bell-Cornell)
W77-09196

ECONOMIC FORECASTING FOR VIRGINIA'S WATER RESOURCE PROGRAMS,
Virginia State Water Control Board, Richmond.
C. P. Becker, A. M. Griffin, Jr., and C. S. Low.
In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 466-472, July 1976. 3 fig, 4 ref.

Descriptors: *Water resources, *Water quality, *Planning, *Economics, *Planning programs, River basins, Projects, Management, Virginia, Forecasting.

Identifiers: *Economic forecasting, *Economic data, Unemployment insurance (U.I.) statistics, Population projections, Value-added, Exponential forecasting, Manufacturing data, Bituminous coal mining.

Water resource and water quality management planning depend to a large degree on forecasts of industrial activity and population projections. A flexible economic data base is especially important where planning follows varying formats of geographical and industrial detail. Records of employment and payroll are collected in the administration of Unemployment Insurance (U.I.) programs and are available from State Employment Agencies. These statistics have been collected over a long period of record (35 years), many of which are available on punched-cards or magnetic tape and may be manipulated by computer. This basic approach has been followed in Virginia. Historical U.I. payroll and employment records for the period 1956 through 1970 were procured on magnetic tape. This data was arrayed by major hydrologic area and by regional planning district. Projections of manufacturing activity were then generated by fitting several exponential equations to annual payroll data in two-digit Standard Industrial Classifications. These exponentials were then extrapolated to provide a range of industrial projections. Other parameters of manufacturing activity were then correlated to payroll data to generate projections of indexes such as employment, value-added, and gross manufacturing out-

put. U.I. payroll data is now being correlated to parameters in nonmanufacturing categories. Projections for industries such as trade and services will link extrapolated payroll data with benchmark correlations of payroll and sales receipts. (See also W77-09154) (Bell-Cornell)
W77-09197

THE COST OF WATER SUPPLY UTILITY MANAGEMENT,
Municipal Environmental Research Lab., Cincinnati, Ohio. Water Supply Research Div.
R. M. Clark, and J. I. Gillelan.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 808-813, July 1976. 5 fig, 6 tab, 5 ref.

Descriptors: *Water supply, *Data collections, *Cost analysis, Water quality, Management, Capital costs, Operating costs, Pricing, Evaluation, Labor, Environment.
Identifiers: Water utilities, Water delivery system, Depreciation analysis.

Passage of the Safe Drinking Water Act has intensified a growing awareness of problems related to the supply of safe drinking water to the American public. Of major concern is the economic impact which might result from promulgation of regulations under the 'Act.' In an attempt to understand these impacts, EPA's Water Supply Research Division is conducting a study in which one or more water utilities are being investigated in each of EPA's ten regions. Herein, representative cost data which have been collected from these case studies are presented. These data will be useful in evaluating the economic impact of the Safe Drinking Water Act. They should also lead to a greater understanding of the economic factors which affect the costs of the various components making up a water supply system. (See also W77-09154) (Bell-Cornell)
W77-09209

WATER SUPPLY SYSTEMS PLANNING, MANAGEMENT AND COMMUNICATION THROUGH AN INTERACTIVE RIVER BASIN SIMULATION MODEL,
Ohio River Div. Labs., Mariemont.
R. A. Hahn.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 824-828, July 1976. 1 fig, 3 ref.

Descriptors: *Water supply, *Planning, *Water management (Applied), *River basins, *Simulation analysis, Communication, Evaluation, Decision making, Alternative planning, Social aspects, Environmental effects, Hydrology, Streamflow, Mathematical models, Operations research.
Identifiers: Economic aspects.

The Washington Metropolitan Area Water Supply Study initiated the development of a unique river basin simulation model designed to be incorporated into an open planning process. The model is a flexible, user oriented tool suitable for a number of different purposes. It has been used to educate Corps personnel in the intricacies of the Washington Area water supply system and to evaluate a number of water supply device alternatives. Potential uses include public demonstration of the complexity of the existing water supply system, evaluation of social, economic, or environmental impacts of water supply alternatives, the modeling of operational rules, and as a 'real-time' decision tool to show the effects of operational management decisions on all parts of the system. (See also W77-09154) (Bell-Cornell)
W77-09212

MANUFACTURING WATER USE SURVEY, 1972 (A SUMMARY OF RESULTS,
Department of the Environment, Ottawa
(Ontario). Water Planning and Management
Branch.

For primary bibliographic entry see Field 3E.
W77-09219

**COASTAL ZONE MANAGEMENT FOCUS ON
NEW ENGLAND; AN ANNOTATED SELECTED
BIBLIOGRAPHY,**

Massachusetts Inst. of Tech., Cambridge.
B. Passero, and M. J. Seale.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 019.
Price codes: A03 in paper copy, A01 in microfiche.
Sea Grant Report No. MITSG 76-21, February 1976. 43 p, 117 ref. SG-04-5-158-1; 04-6-158-44-007.

Descriptors: *Bibliographies, *New England, Coasts, Ecosystems, Resources, Planning, Water resources, Recreation demands.
Identifiers: *Coastal Zone Management, Coastal processes.

The materials for this bibliography were chosen from two major sources: Dennis Ducusik's Teaching Zone Management—An Introductory Course Syllabus (MIT Sea Grant Program Publication No. MITSG 75-1) and the MIT Sea Grant Program's collections. The bibliography is not designed primarily for the beginning student, although the first section contains articles that introduce the complexities of coastal zone management. Coastal planner, researchers, conservationists, and other special groups might best benefit from the technical materials listed in the other seven sections. (Sinha-OEIS)
W77-09241

URBAN WATER PLANNING, A BIBLIOGRAPHY, VOLUME 2.

Office of Water Research and Technology, Washington, D. C.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 510.
Price codes: A09 in paper copy, A01 in microfiche.
Water Resources Scientific Information Center, Report OWRT/WSIC 77-209, June 1977. 189 p.

Descriptors: *Urban hydrology, *Bibliographies, *City planning, *Municipal water, *Water supply, *Alternative planning, *Comprehensive planning, Management decision making, Land use, Economics, Urbanization, Regional analysis, Simulation analysis, Water resources development.

This report, containing 181 abstracts, is another in a series of planned bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 104,878 abstracts covering SWRA through February 1977 (Volume 10, Number 4). Author and subject indexes are included. (See also W72-12921.)
W77-09264

**PREDICTING CHANGES IN LAND-USE PATTERNS
RESULTING FROM WATER
RESOURCE INVESTMENT USING A NON STATIONARY MARKOV PROCESS,**
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
H. E. Drummond.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 409.
Price codes: A07 in paper copy, A01 in microfiche.
—Oklahoma Water Resources Research Institute, Stillwater. Completion Report, (1977). 121 p, 9 fig, 36 tab, 19 ref, append. OWRT B-030-OKLA(1), 14-31-0001-5105.

Descriptors: Evaluation, *Post-impoundment, *Projections, *Land use, *Investment, *Markov processes, Forecasting, *Oklahoma, Reservoirs, *Pre-impoundment, Social change.
Identifiers: *Keystone(Okla), Pine Creek(Okla).

Changes in land use patterns in the immediate vicinity of Keystone and Pine Creek reservoir projects in eastern Oklahoma are evaluated using stationary and non-stationary Markov chain procedures. The objective of the procedure is to estimate the net or differential change in land use patterns caused by the development of the water resources development project. Pre-project growth patterns are extrapolated into the future to estimate what the land use pattern would have been if the project had not occurred. The difference between these estimates and observed land use patterns is the estimated net impact of the project. By evaluating both pre-project and post-project land use change patterns, it is possible to determine the future differential land use changes associated with the project development. In both study areas the project caused an abrupt shift in land use patterns immediately following construction of the reservoir. While most non-agricultural use categories showed net increases, the greatest increases immediately after the project are in the infrastructure categories of roads, business, etc. In the Keystone area, the initial net increase in non-agricultural uses is projected to continually expand; while in Pine Creek, the initial net increase is projected to dissipate such that by 2000 little net change is estimated.
W77-09268

**RECREATION USAGE IN THE KISSIMMEE
RIVER BASIN, FLORIDA,**

Florida Univ., Gainesville. Dept. of Food and Resource Economics.
M. Behar.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 514.
Price codes: A05 in paper copy, A01 in microfiche.
Master's Thesis, 1972. 79 p, 4 fig, 17 tab, 14 ref, 2 append. OWRT B-007-FLA(2), 14-31-0001-3267.

Descriptors: *Water allocation(Policy), Water utilization, Water demand, Decision making, *Florida, *Recreation, *Recreation, *Recreation demand, Estimating, Regression analysis, *Model studies, *Social values, Temperature, Wind velocity, Water levels.
Identifiers: *Kissimmee River basin(Fla).

The purpose was to illustrate a methodology to determine the total recreational use of the Kissimmee River Basin. In order to estimate the number of recreationists at the river basin, a sample of three lakes was chosen. Once the estimate was established for the sampled area, it was projected for the entire river basin. The total number of visitors, to the Kissimmee River Basin in 1970 was estimated to be 813,750. The estimated total net value of recreation was 16.275 million dollars per year. A multiple linear regression equation was established for each lake sampled in order to examine the influence of water level and certain physical variables used to estimate the recreational use of any lake in the Kissimmee River Basin. The results derived from the regression equation indicate that recreational use of a lake varies inversely with the physical variables temperature and wind velocity and directly with the water level. Seasonality was accounted for when deriving the final results.
W77-09269

**POTENTIAL WATER RECREATION OPPORTUNITIES AT MUNICIPAL AND PRIVATE
FOREST MOUNTAIN RESERVOIRS,**

Colorado State Univ., Fort Collins. Dept. of Recreation Resources.
R. Aukerman, and W. McLaughlin.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 513,

Price codes: A02 in paper copy, A01 in microfiche.
Paper Presented at Society of American Foresters National Conference, 1974, New York City, Published in SAF Proceedings, 1974. 13 p, 3 fig, 6 tab, 13 ref. OWRT B-104-COLO(1).

Descriptors: *Management, *Recreation, *Reservoirs, Drawdown, Timing, Delivery, Storage, Surveys, *Colorado, Multiple-purpose projects, Decision making, Planning.
Identifiers: *Mountains of Front Range(Colo).

The objective is to provide managers with tools to create more meaningful recreation opportunities for the public. Water recreation managers are faced with increasing resource constraints, rapidly growing numbers of over-used sites, and a growing set of management strategies. Solutions to these problems are complex and often little is known about the spin-off effects that management decisions will create. This study attempts to provide the scientific rationale for recommending management practices which will lead to increased recreation use of high-mountain reservoirs. The study objectives are to: (1) inventory existing reservoir sites along Colorado's Front Range; (2) look at the physical capabilities of sites to provide a recreation experience; (3) survey present users in order to identify site and activity preferences; (4) design a model to evaluate the interactions between existing site management, user preferences, and physical capabilities of sites for providing recreation experiences; and (5) look at alternative management strategies to meet future types of recreation demand with minimal influence on the quality of present recreation experience. An overview is presented of an approach to evaluate the recreation potential of high-mountain reservoirs. The data presented represents a first generalized look at a complex and encompassing study. (See also W75-09894)
W77-09272

**LAND MANAGEMENT IN THE LAKE ONTARIO
BASIN,**

Cornell Univ., Ithaca, N.Y.
J. M. Wolf.

Available from the National Technical Information Service, Springfield, VA 22161 as COM-74-10336. Price codes: A03 in paper copy, A01 in microfiche. New York State Sea Grant Program, Great Lakes Management Problems Series, December 1973. 39 p, 7 fig, 2 tab, 28 ref. OWRT C-2145(No. 3370)(2).

Descriptors: *Land use, *Lake Ontario, *Planning, *Watershed management, *Land management, Land development, Population, Growth rates, Zoning, Taxes, Eminent domain, Regional development, Rural areas, Urbanization, International commissions, Future planning, *New York, *Canada.
Identifiers: Binational development, Buffalo-Rochester(NY), Toronto, Ontario.

Binational multiresource development is essential if the enormous water resources of Lake Ontario are to be properly utilized. Such development must place heavy emphasis on land use planning. The Lake Ontario region consists of a 15,200 square mile drainage basin in N. Y. and Pa., and a 12,000 sq. mile basin in the Province of Ontario. Rapid population growth and urbanization are apparent, especially on the Canadian side with an increase from 3.8 million in 1968 to a projected 4.6 million by 1976. Growth plans for Ontario were begun in 1966 with the Design for Development program which included the formulation of regional and local plans stressing environmental, development and economic performance. For example, a plan for the Toronto centered region comprised three concentric zones, a lakeshore urbanized area, a commutershed, and a peripheral area. While Canadian land use planning is more thorough than New York, it lacks the enforcement capabilities of the latter. Future urban growth must consider the rural land which is removed

Field 6—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

from farm production for reasons of land speculation, housing, or commerce. Estimates from Canadian and American studies indicate that 382 rural acres are lost for every 1000 increase in population for Toronto and 193 for Buffalo-Rochester. Higher taxes, higher market value, and soaring prices are the main causes of this land loss. To prevent loss of productive land joint management by the U.S. and Canada of the Ontario River basin is required, including an information gathering system and enforcement capabilities. (LaPointe-North Carolina)
W77-09275

WATER RESOURCE AND LAND USE PROBLEMS IN WESTERN AUSTRALIA.
Perth Public Works Dept. (Australia). Planning Design and Investigation Branch.
For primary bibliographic entry see Field 4C.
W77-09296

THE CENTRAL ARIZONA PROJECT: AN INQUIRY INTO ITS POTENTIAL IMPACTS.
Arizona Univ., Tucson. Coll. of Business and Public Administration.
J. L. Barr, and D. E. Pingry.
Arizona Review, Vol. 26, No. 4, p 1-49, April, 1977. 3 fig, 13 tab, 34 ref, 10 append.

Descriptors: *Arizona, *Colorado River, *Colorado River Basin, *Economic impact, *Water policy, Arid lands, Water supply, Water supply development, Environmental effects, Social impact, Urban impact, Competing uses, Water law, Water allocation(Policy), Water resources, Water resources development.
Identifiers: *Central Arizona project.

The Central Arizona Project is evaluated in terms of water availability in Arizona and the problem of possession of title to Colorado River water is discussed. The background of the project is presented, as well as an assessment of its costs and overall impact. The problem of who has claim to the Colorado River water is evaluated. According to strict interpretation, the Central Arizona Project is not guaranteed any Colorado River water. Rather, it would be claimant to an amount of water each year determined as a residual to other claims that enjoy higher priority in the lower Colorado River Basin. There is a detailed discussion of the potential of the Colorado River for supplying water to Arizona. Four simulation experiments are presented to provide some indication of project delivery costs. Further study is suggested before a complete evaluation of the Central Arizona Project's potential impact can be made. Five policy options are presented. These include: (1) proceed with the presently designed CAP, (2) redesign the CAP, (3) delay the CAP, (4) scrap the CAP, or (5) package the CAP with requisite water use reform. (Jamail-Arizona)
W77-09298

WATER RECLAMATION: TECHNOLOGY AND PUBLIC ACCEPTANCE.
Stone (Ralph) and Co., Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 5D.
W77-09317

URBAN PLANNING TO MINIMIZE ENVIRONMENTAL IMPACT.
Illinois Univ. at Chicago Circle. Dept. of Systems Engineering.
D. Bammi, D. Bammi, and R. Paton.
Environment and Planning A, Vol 8, No 3, p 245-59, May 1976. 2 fig, 3 tab, 11 ref, 2 append.

Descriptors: *Environmental effects, *Land development, Urban land use, Natural resources, Computer models, *City planning, Cities.
Identifiers: *Environmental cost, *Natural resources, Environmental cost matrix, Environmental impact.

A linear programming model (OPTPLAN) that allocates land use to minimize environmental impact has been developed. This paper describes the model's natural resource objective function and constraints. The objective function minimizes the cost to the environment of land development. The cost is calculated by considering the natural features in each analysis region and assessing the effect of devoting a parcel of land with a specific combination of features to a specific land use. The environmental cost of a particular land use in a given region is obtained by the summation over all environmental conditions of the products of: (1) the acreage for a particular environmental condition in that region; (2) the environmental cost of a particular pair of environmental conditions and land use types; (3) the reciprocal of the net undeveloped acreage in the region. An environmental cost matrix that assigns numeric costs to a cross-tabulation of environmental conditions and land use types is explained. Four constraints were introduced: (1) open space acreage must be greater than acreage designated environmentally sensitive; (2) open space allocations must fall within accepted standards; (3) open space in each region must be greater than or equal to minor flood plain acreage; (4) land reservation for future open space needs must meet accepted standards. (Nessa-NC)
W77-09377

ANTI-POLLUTION BEHAVIOR: A FUNCTION OF PERCEIVED OUTCOME AND LOCUS OF CONTROL.
For primary bibliographic entry see Field 6G.
W77-09378

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PREVIEW.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09379

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SUMMARY.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09380

BINGHAMTON WASTEWATER MANAGEMENT STUDY: BACKGROUND INFORMATION APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09381

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PLAN FORMULATION APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09382

BINGHAMTON WASTEWATER MANAGEMENT STUDY: COMMENTS APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09383

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SPECIALTY APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09384

BINGHAMTON WASTEWATER MANAGEMENT STUDY: IMPACT ASSESSMENT AND EVALUATION APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09386

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PUBLIC INVOLVEMENT APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09388

INDUSTRIAL WATER USE.
Public Health Service, Washington, D.C. Div. of Water Supply and Pollution Control.
For primary bibliographic entry see Field 6D.
W77-09449

RESTORING THE WILLAMETTE RIVER: COSTS AND IMPACTS OF WATER QUALITY CONTROL.
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 5G.
W77-09455

THE ECONOMIC IMPACT OF ENVIRONMENTAL PROGRAMS.
Council on Environmental Quality, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-239 773, Price codes: A03 in paper copy, A01 in microfiche. December 1974. 29 p, 5 fig, 8 tab.

Descriptors: *Pollution abatement, *Economics, *Economic impact, Costs, Environmental control, Environmental engineering, Capital costs, Investment, Operating costs, Maintenance costs, Depreciation, Industries, Inflation(Economic), Projections, Forecasting, Air pollution, Water pollution control, Industries.

Council of Environmental Quality analyses in 1974 are given for the 10-year period 1973-1982, for incremental abatement costs projected to meet the requirements of federal legislation enacted since the mid-1960's—beyond what the nation would have spent for the same purposes in the absence of this legislation. Three types of costs are projected: (1) Investment costs—the estimated expenditures which will be made on capital equipment for pollution abatement by both public and private sectors; (2) Capital costs—which include interest charges on pollution control investments and the depreciation of the capital equipment; (3) Operation and maintenance costs created by the pollution abatement process. The report also summarized macroeconomic impacts of environmental expenditures on inflation, investment, productivity, economic growth, employment, government finances, foreign trade and income distribution. Impacts are also projected for eight industry groupings which account for about 80% of the total estimated private pollution control investments in 1974. These include electric utilities, petroleum refining, iron and steel, pulp and paper, nonferrous metals, stone, clay, glass and cement, chemicals and food and kindred products. (Harris-Wisconsin)
W77-09457

SITING OF MAJOR ENERGY FACILITIES.
Organization for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6G.
W77-09459

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE FEDERAL REPUBLIC OF GERMANY.
Organisation for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6E.
W77-09461

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN CANADA.
Organisation for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6E.
W77-09462

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN FRANCE.
Organisation for Economic Co-Operation and Development Paris (France).
For primary bibliographic entry see Field 6E.
W77-09463

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE NETHERLANDS.
Organisation for Economic Co-Operation and Development, Paris (France).
For primary bibliographic entry see Field 6E.
W77-09464

SIMULTANEOUS INVESTMENT-ALLOCATION: AN APPLICATION OF GENERALIZED BENDERS DECOMPOSITION TO WATER PLANNING.
Texas Univ., at Austin. Center for Cybernetic Studies.
For primary bibliographic entry see Field 6A.
W77-09466

ECONOMIC INCENTIVES FOR LAND USE CONTROL.
CONSAD Research Corp., Pittsburgh, Pa.
F. H. Rueter, and P. Kushner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 468.
Price codes: A16 in paper copy, A01 in microfiche.
Report No. EPA-600/5-77-001, February 1977. 369 p. 5 fig., 1029 ref. IHC619, EPA 68-01-2699.

Descriptors: *Land use, *Theoretical analysis, *Economic efficiency, *Regulation, Methodology, Land management, Evaluation, Economic impact, Social impact, Zoning, Taxes, Legal aspects, Political constraints, Property values, Building codes, Condemnation, Optimization, Social values, Political aspects.
Identifiers: Externalities.

A theoretical economic analysis of the incentives embodied in a variety of regulatory land use policies is developed to aid in understanding the rationality of the behavior patterns which have produced unanticipated and economically inefficient impacts and to provide a conceptual basis for the establishment of improved land use controls. The economic and legal relationships between alternative assignments of property rights in the use of resources and the levels of external effects of this resource use are examined. Also investigated are administrative, economic, judicial, legal, and political problems which arise in the application of traditional land use control mechanisms such as municipal zoning, building codes, and eminent domain condemnations. Basic concepts are developed for the evaluation of the potential economic efficiency and social desirability of any mechanism intended for the optimal control of negative externalities or the optimal provision of public facilities. They are then utilized to assess the potential economic efficiency, legal feasibility, administrative tractability, political acceptability, and social desirability of implementing seven innovative regulatory policies, including ad valorem property taxation with tax rates conditional upon land use, and payment of annual externality fees by property owners who generate adverse external effects. (Luedtke-Wisconsin).
W77-09467

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL.
Ohio State Univ. Research Foundation, Columbus.
For primary bibliographic entry see Field 5G.
W77-09481

BENEFIT-COST ANALYSIS: ITS USE (MISUSE) IN EVALUATING WATER RESOURCE PROJECTS.
P. E. Roberts.
American Business Law Journal, Vol 14, No 1, p 73-84 (Spring 1976). 1 tab.

Descriptors: *Cost-benefit analysis, *Economics, *Administrative agencies, *Costs, *Benefits, Economic justification, Planning, Economic prediction, Feasibility, Financial feasibility, Project feasibility, Social impact, Social aspects, Cost-benefit theory, Federal government, Market value, Cost-benefit ratio, Project planning, Political aspects.
Identifiers: *National Environmental Policy Act, *Environmental impact statement.

The National Environmental Policy Act (NEPA) was enacted to insure a balance between the developmental interests of federal agencies and environmental quality objectives. Explicit in NEPA is the requirement for economic analysis. Both the concept itself in relation to environmental matters and the manner in which economic analysis is used have proved troublesome. As to the concept itself, the major problem lies in the attempt to quantify natural resources. Necessary considerations for a determination of market value are buyer-seller transactions, divisibility of goods and services and immediate agreed-upon price. All these considerations are lacking in the environmental sphere. The requirements for economic analysis are explicit in NEPA. However, the integration of environmental factors with economic relationships has not occurred. NEPA requires the preparation of an Environmental Impact Statement (EIS) for any action of the federal government which may have a significant effect on the environment. This requirement does not include any judgemental implication concerning the merits of the issue, but merely an enumeration of effects, real and potential. The opinion is growing that economic data should be included in the EIS. While it is essential that economic data and assumptions be revealed, it is more important that these data be subjected to alternate analysis in order to test the reasonableness of assumptions and conclusions, and strengthen the entire administrative decision process. (Moorhouse-Florida)
W77-09550

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

MATHEMATICAL MODELS FOR CALCULATING PERFORMANCE AND COST OF WASTE-WATER TREATMENT SYSTEMS.
Municipal Environmental Research Lab., Cincinnati, Ohio. Systems and Economic Analysis Section.
For primary bibliographic entry see Field 5D.
W77-09208

PREDICTING CHANGES IN LAND-USE PATTERNS RESULTING FROM WATER RESOURCE INVESTMENT USING A NON STATIONARY MARKOV PROCESS.
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W77-09268

BINGHAMTON WASTEWATER MANAGEMENT STUDY: DESIGN AND COST APPENDIX.
Army Engineer District, Baltimore, Md.

For primary bibliographic entry see Field 5G.
W77-09385

INDUSTRIAL EFFLUENT SURCHARGING: A CASE STUDY OF KITCHENER, ONTARIO, Toronto Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 5G.
W77-09413

DO ECONOMIES OF SCALE EXIST IN WATER UTILITY.
Illinois Univ. at Urbana-Champaign. Coll. of Commerce and Business Administration.
For primary bibliographic entry see Field 5F.
W77-09450

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOLUME 1. EXECUTIVE SUMMARY.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09451

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PET. REFINING IND. VOL. 2, PTS 1 AND 2. IND. DESCRIPTION AND TECH. ANALYSIS.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09452

ECONOMIC IMPACT OF EPA'S REGULATIONS ON THE PETROLEUM REFINING INDUSTRY. VOL. 3, PT. 3. ECONOMIC IMPACT ANALYSIS.
Sobotka and Co., Inc., Stamford, Conn.
For primary bibliographic entry see Field 5G.
W77-09453

TECHNICAL AND MICROECONOMIC ANALYSIS: ARSENIC AND ITS COMPOUNDS.
Versar, Inc., Springfield, Va.
For primary bibliographic entry see Field 5B.
W77-09465

ECONOMIC INCENTIVES FOR LAND USE CONTROL.
CONSAD Research Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 6B.
W77-09467

ECONOMIC ASSESSMENT OF PROPOSED TOXIC POLLUTANT EFFLUENT STANDARDS FOR MANUFACTURERS AND FORMULATORS OF ALDRIN/DIELDRIN, DDT, ENDRIIN AND TOXAPHENE.
Little (Arthur D.), Inc., Cambridge, Mass.
For primary bibliographic entry see Field 5G.
W77-09478

METHODOLOGY FOR ASSESSING ENVIRONMENTAL IMPLICATIONS AND TECHNOLOGIES: NONFERROUS METALS INDUSTRIES.
Battelle-Columbus Labs., Columbus, Ohio.
For primary bibliographic entry see Field 5G.
W77-09479

AN OPTIMAL STATE WATER LAW: FIXED WATER RIGHTS AND FLEXIBLE MARKET PRICES.
For primary bibliographic entry see Field 6E.
W77-09587

Field 6—WATER RESOURCES PLANNING

Group 6D—Water Demand

6D. Water Demand

RURAL WATER DISTRICTS IN KANSAS.

Kansas Water Resources Board, Topeka.
Bulletin 18, 1975. 95 p, 3 fig, 1 tab, 68 plate, 12 ref.

Descriptors: *Kansas, *Rural areas, *Cooperatives, *Water districts, Legislation, Flooding, Droughts, Organizations, Water users, Water distribution(Applied), Water works, Data collections, Water supply.
Identifiers: *Rural water districts(Kan).

This report was assembled in response to requests for information concerning the role which rural water districts play in meeting the water needs of Kansas citizens. The information contained herein updated a previous compilation which was published in 1967. The information was assembled in three sections. The first part, a brief text, contained information concerning the method of organization, the duties, and powers, and the financing of the rural water districts of Kansas. The second section was composed of a table which listed the rural water districts serving each county of Kansas. The third section of the report consisted of plates of each county which delineated the area of the county served by rural water districts. (Froehlich-ISWS)

W77-09135

CAPACITY EXPANSION FOR MUNICIPAL WATER AND WASTEWATER SERVICES: INCORPORATION OF UNCERTAINTY.

Curran Associates, Inc., Northampton, Mass.
For primary bibliographic entry see Field 5D.
W77-09201

ADAPTIVE SHORT-TERM WATER DEMAND FORECASTING.

Systems Control, Inc., Palo Alto, Calif.
D. H. Budenaers.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 646-650, July 1976. 8 fig, 2 tab, 7 ref. ORWT C-6198(5221)(4).

Descriptors: *Water demand, *Forecasting, *Model studies, *Weather, Estimating, Stochastic processes, Temperature, Hydrology, Simulation analysis, Systems analysis, Water distribution(Applied).
Identifiers: Principal components method, Time series modeling.

A dual set of short-term water demand models is described. These models have the feature of adaptability to changing data: given changes in the data sequence, the models' parameters will self-adjust to provide a better model. The models also have the property of being real-time computer-implementable. The two models are a stochastic (or time series) model and weather component of demand model. The stochastic model is an extension of the Box-Jenkins type of modeling for time series. The weather model uses the method of principal components to identify the effective weather variables. The results of the application of these models to data from the San Jose, California Water Works are presented. (See also W77-09154) (Bell-Cornell)

W77-09202

HYDROLOGIC IMPACT STUDIES OF ALTERNATIVES TO MEET WATER NEEDS IN SOUTH CENTRAL PENNSYLVANIA.

Resource Analysis Inc., Cambridge, Mass.
D. H. Marks, J. V. Guillermo, B. M. Harley, and J. C. Schaake, Jr.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016,

U.S. Environmental Protection Agency, Washington, D.C., p 651-656, July 1976. 3 fig, 4 tab, 9 ref, 2 append.

Descriptors: *Water supply, *Methodology, *Synthetic hydrology, *Streamflow, *Groundwater, *Simulation analysis, Water demand, Hydrologic data, Surface waters, Model studies, Equations, Systems analysis, *Pennsylvania.
Identifiers: *Impact assessment, Linear regression model.

This paper presents the use of several interrelated models to investigate the potential hydrologic impacts of several proposed water supply alternatives for the South Central Pennsylvania area. The major demand centers depend for the most part on local surface waters for their water supply with supplemental withdrawals from the Susquehanna River and from groundwater. Withdrawals from all of these sources could have an impact on the flows in the Susquehanna itself. Since this river is the main source of freshwater to Chesapeake Bay, it was important to assess the relative impact of each of the proposed alternatives on the outflow distribution of the Bay. The study scope was limited to the hydrologic aspects of the problem. The models used to evaluate the impacts of the alternatives were: (1) a synthetic streamflow augmentation and generation model to first augment the existing records up to a full 80 years, and second to generate a set of 200-year synthetic records which resembled the historical records in their statistics; (2) a linear regression model relating monthly rainfall and evapotranspiration to streamflow in the tributaries used to evaluate the impact of groundwater withdrawals on surface water flows; and (3) a simulation model used as an accounting device to show the impact of the alternatives on the monthly flows at several locations in the area including the outflow of the Susquehanna to Chesapeake Bay. (See also W77-09154) (Bell-Cornell)

W77-09203

MATHEMATICAL MODELING OF DUAL WATER SUPPLY SYSTEMS.

Weston (Roy F.), Inc., West Chester, Pa.
A. K. Deb, and K. J. Ives.

In: Proceedings of the Conference on Environmental Modeling and Simulation, April 19-22, 1976, Cincinnati, Ohio. Report EPA 600/9-76-016, U.S. Environmental Protection Agency, Washington, D.C., p 814-818, July 1976. 4 fig, 4 tab, 5 ref.

Descriptors: *Water supply, *Water treatment, *Water distribution(Applied), *Water demand, *Economic feasibility, Water quality control, Domestic water, Potable water, Evaluation, Capital costs, Operating costs, Computers, Mathematical models, Systems analysis.
Identifiers: *Cost functions, Nonpotable water, Pumping mains, Gravity mains, Technical feasibility.

A small percent of total domestic water usage is usually required to be of potable water quality; the rest of domestic need may not warrant excellent quality. Dividing water supply into two portions, potable and nonpotable, mathematical models of conventional and dual supplies have been developed to evaluate the technical and economic feasibility of dual supplies under various conditions. Model sensitivity has been evaluated for various parameters. The econo-mathematical models for single and dual supply for 12 treatment systems of total present costs of treatment and distribution of water were solved using a high-speed computer for various potable/total flow ratios, interest rates, capital cost increase rates, operational cost increase rates for a-type (base population 100,000) and B-type (base population 500,000) towns. The computer output comprises total treatment costs, both capital costs and O and M costs, and total distribution costs for all the 12 systems. The cost advantage of dual supply over single supply, DEL, is expressed by the difference of

total present value costs of single and dual systems in pounds sterling. (See also W77-09154) (Bell-Cornell)

W77-09210

MANUFACTURING WATER USE SURVEY, 1972 - A SUMMARY OF RESULTS.

Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch.
For primary bibliographic entry see Field 3E.
W77-09219

INDUSTRIAL WATER USE.

Public Health Service, Washington, D.C. Div. of Water Supply and Pollution Control.
W. G. Eichberger.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 739. Price codes: A07 in paper copy, A01 in microfiche. Report No 282028, February 1965. 130 p, 1 fig, 21 tab.

Descriptors: *Industrial water, *Water utilization, *Industries, *Water demand, *Industrial wastes, Data collections, Waste water(Pollution), Baseline studies.

U.S. Public Health Service-compiled data on industrial water requirements, arranged according to standard industrial classifications, is given along with industrial waste water production based on broad U.S. or regional averages up to 1959. Caution should be used when applied to local situations. Table 1 shows industrial water requirements per employee and per dollar value added. Table 2 shows industrial water requirements by product unit, for four-digit classifications. Table 3 gives information on water intake and gross water use per employee and per-dollar value added, of intake water used for processing and cooling, and amount of water discharged per employee by two-digit and specified four-digit industries by regions. Table 4 presents data on water use by regions, subdivided by industrial categories. Table 5 compares industrial water use per year among 42 selected industries. Table 6 presents industrial water requirements for specific products. Table 7 summarizes waste discharges, by severed population equivalents of BOD and SS, for various industrial wastes. Table 8 gives data on the volume and characteristics of canning industry wastes. Tables 9 through 13 present waste generation for specified industries. The waste production data should be used with considerable discretion, as they are intended only as estimating guides. A listing of the standard industrial classifications defines the industries and products. (Auen-Wisconsin)

W77-09449

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE FEDERAL REPUBLIC OF GERMANY.

Organisation for Economic Co-Operation and Development, Paris (France).

For primary bibliographic entry see Field 6E.
W77-09461

WATER LAW - WELL PERMITS - UNAPPROPRIATED WATER AND MAXIMUM UTILIZATION, HALL V. KUIPER, 510 P.2D 329 (COLO. 1973).

T. F. Cope.
Denver Law Journal, Vol 51, No 1, p 127-144. 1974.

Descriptors: *Colorado, *Surface waters, *Water demand, *Water allocation(Policy), Water policy, Water shortage, Water users, Well permits, Regulation, Wells, Groundwater, Judicial decisions, Legal aspects, Groundwater availability, Priorities, Prior appropriation.

Identifiers: *Ground Water Management Act, Maximum utilization.

Increased development in Colorado has led to increased demand for water, with surface water becoming scarcer as a result. This growing scarcity has had two effects. The first is an increase in the number of wells drilled in recent years which has led to conflicts between ground and surface water users. Consequently, the Ground Water Management Act was developed to set up a permit system for wells. The second effect of the increasing scarcity is the articulation of the doctrine of maximum utilization. The drive to make water available to as many people as possible who will put it to a beneficial use is the common factor in decisions dealing with maximum utilization. In a recent case the Colorado Supreme Court redefined the requirement of unappropriated water, thereby implicitly rejecting one aspect of maximum utilization. Another notable doctrine has evolved from the scarcity of water, the doctrine of prior appropriation. The doctrine of prior appropriation allocates water while the doctrine of maximum utilization insures that water is efficiently used. (Rieck-Florida)
W77-09543

6E. Water Law and Institutions

RURAL WATER DISTRICTS IN KANSAS.

Kansas Water Resources Board, Topeka.
For primary bibliographic entry see Field 6D.
W77-09135

THE ENVIRONMENTAL IMPULSE AND ITS COMPETITORS: ATTITUDES, INTERESTS, AND INSTITUTIONS AT LAKE TAHOE.
California Univ., Davis, Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W77-09145

THE CENTRAL ARIZONA PROJECT: AN INQUIRY INTO ITS POTENTIAL IMPACTS,
Arizona Univ., Tucson, Coll. of Business and Public Administration.
For primary bibliographic entry see Field 6B.
W77-09298

INSTITUTIONAL CONSTRAINTS ON WATER RESOURCE DEVELOPMENT IN ARID LANDS,
O. W. Templar.
In: Social Science Research in the Dry Lands, Templar, O. W. ed. Frontiers of the Semi-Arid World: An International Symposium, October 14-18, 1974, Lubbock, Texas. ICASALS Publication no. 76-6, Lubbock, 1976, p. 25-39. 2 fig, 35 ref.

Descriptors: *Arid lands, *Water supply, *Water law, *Water policy, *Water allocation(Policy), Water demand, Water resources, Water resources development, Water rights, Governments, Groundwater, Riparian rights, Legal aspects, *Institutional constraints.

The most important consideration influencing occupancy and land use in the world's most arid lands is the availability of water. Water availability is in turn influenced not only by the physical environment, but also by the institutional or legal framework controlling the allocation of existing water supplies, or the question of water rights. Private water rights in arid lands and water rights systems in various countries and societies are discussed and the institutional constraints imposed by water law evaluated. The best solution for achieving coordinated and efficient management of water resources in the arid lands, or in any other region where there is heavy water demand, would be for the appropriate jurisdiction to institute an all inclusive appropriation system for application to water in whatever phase of the hydrologic cycle it might exist. Although this has not yet been done

in practice, and despite the fact that such implementation would be difficult, until such a system is put into operation correlation and management of water rights in all phases cannot be achieved. (Jamail-Arizona)
W77-09316

WETLANDS-RELATED LEGISLATION IN THE UNITED STATES.
Miami Univ., Fla. School of Law.
W. P. Stepien, Jr., and S. J. Fernandez.
Miami University Sea Grant Special Report No. 11, May 1977. 64 p.

Descriptors: *Legislation, *Wetlands, Coasts, United States, *State governments, *Standards, *Administrative agencies.

Arranged in a state by state order, this publication identifies statutes, provides definition, explains briefly prohibited acts and/or authorizations, lists administrative schemes, and gives standards for use and development of wetlands both inland and coastal of the United States. (See also W75-11550) (NOAA)
W77-09324

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PREVIEW.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09379

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SUMMARY.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09380

BINGHAMTON WASTEWATER MANAGEMENT STUDY: BACKGROUND INFORMATION APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09381

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PLAN FORMULATION APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09382

BINGHAMTON WASTEWATER MANAGEMENT STUDY: COMMENTS APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09383

BINGHAMTON WASTEWATER MANAGEMENT STUDY: INSTITUTIONAL ANALYSIS APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09387

BINGHAMTON WASTEWATER MANAGEMENT STUDY: PUBLIC INVOLVEMENT APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09388

ENVIRONMENTAL POLICY-MAKING IN THE USSR: THE ROLE OF INDUSTRIAL AND ENVIRONMENTAL INTEREST GROUPS.
Mississippi State Univ., State College.
D. R. Kelly.
Soviet Studies, Vol. XXVIII, No. 4, p. 570-589, 1976. 56 ref.

Descriptors: *Decision making, *Pollution abatement, *Political aspects, *Political constraints, *Institution constraints, *Foreign countries, Local governments, Jurisdiction, Lakes, Pulp and paper industry, Pulp wastes, Public health.
Identifiers: *USSR, *Lake Baikal(USSR), *Environmental policymaking, *Public interest groups.

An examination of the issues, organized interests and underlying power relationships that provide a general background for environmental policymaking in the Soviet Union considers several new dimensions of interest group behavior including: (1) the role of non-institutionalized ad hoc environmental lobbies; (2) the critical and often overlooked question of how new issues are created and politicized, and through what channels; (3) the interrelationship of a number of decisional levels in a complex and multi-levelled policymaking milieu. The multi-level process of Soviet environmental policymaking is illustrated by a case study of a recent clash over pollution of Lake Baikal in Siberia. This policy struggle was fought out on one side by the Ministry of Timber, Paper and Woodworking whose cellulose mills represent a major threat to the lake, as opposed by a diverse coalition of conservationists, scientists, writers and other supporting the Ministry of Land Reclamation and Water Resources, the Hydrometeorological Service and the Ministry of Public Health. The actual policymaking process for Baikal, taking place in a complex and multi-levelled interagency and intergroup setting, eventually created stringent controls against the lakeside polluters. (Harris-Wisconsin)
W77-09456

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE FEDERAL REPUBLIC OF GERMANY.
Organisation for Economic Co-Operation and Development, Paris (France).
Environment Directorate 29400, 1976. 60 p, 15 fig, 16 tab.

Descriptors: *Foreign countries, *Water management(Applied), *Water policy, Federal-state water rights conflicts, Federal government, State governments, Water distribution(Applied), Water quality control, Water resources development, Regulation, Management, Water law, Water allocation(Policy), Administration, Pollution taxes(Charges), International commissions.
Identifiers: *West Germany.

As part of a study of national policies and systems for water management in eight member countries of the Organization for Economic Cooperation and Development, the policies, orientation and instruments of water management of West Germany are reviewed. Concentrating on water quality management, German water policy elements as described include federal/state relationships, water quality parameters, investments in waste water treatment, financial aids for water treatment facilities, descriptions of river basin management systems, effluent fees and water abstraction fees. General water management policy in Germany is established by a federal water act, under which all water use schemes must meet the demands on the available water resources with respect to quality and quantity by adequate management. Through directives issued by the federal government, general water schemes are drawn up for the entire country. The schemes are based on debit/credit water balances, take into account water pollution and control and flood protection, and are carried out by the state governments. On the working level, there are technical instructions issued with the directives, the German Industrial Standards relating to water management. Other rights are reserved to the individual states. (Harris-Wisconsin)
W77-09461

Field 6—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN CANADA.

Organisation for Economic Co-Operation and Development, Paris (France).
Environment Directorate 29315, 1976. 62 p, 1 fig, 5 tab.

Descriptors: *Water management(Applied), *Canada, *Water policy, Water distribution(Applied), Water quality control, Water resources development, Regulation, Management, Water law, Water allocation(Policy), Administration, Economics, Pollution taxes(Charges), International commissions.

As part of a study of national policies and systems for water management in eight member countries of the Organization for Economic Cooperation and Development, the problems, management policy instruments and institutional framework of water management in Canada are analyzed. The study includes a description of Canada's principal hydrologic characteristics and enumerations of the provincial and federal water management policy instruments for water quality and quantity management, research and education, regulation and enforcement, economic water quality controls and water quality control by comprehensive management. Aside from the structural factors imposed by Canada's system of government, which gives extensive autonomy to the provinces, there is a wide diversity of public policy with regard to water which may also reflect continent-wide physical characteristics. The size of Canada and its varying topographic and hydrological characteristics make it difficult to conceive of unified, nationally applicable specific policies that would be practicable in more than a few areas of public concern. Evidence suggests, however, that a regulatory approach to water management is beginning to find favor; this is especially true at the municipal level in regard to water quality control through the use of economic charges. (Harris-Wisconsin)
W77-09462

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN FRANCE.

Organisation for Economic Co-Operation and Development Paris (France).
Environment Directorate 29313, 1976. 65 p, 14 fig, 16 tab.

Descriptors: *Foreign countries, *Water management(Applied), *Water policy, Water distribution(Applied), Water quality control, Water resources development, Regulation, Management, Water law, Water allocation(Policy), Administration, Economics, Pollution taxes(Charges), Use rates, International commissions.
Identifiers: *France.

As part of a study of national policies and systems for water management in eight member countries of the Organization for Economic Cooperation and Development, the problems, management and programs of the water management system of France is analyzed. Described in the report are: (1) regulatory aspects in terms of legal and institutional structures, including a description of the statutory framework, licensing procedures, enforcement and sanctions and governmental water management institutions; and (2) economic aspects, including water user charges, pollution charges and a description of the recent Sixth Plan (1971-1976). The functions of the Agenciers Financiers de Bassin are enumerated; these agencies, the technical and economic management instrument for river basins in France, are empowered to levy charges on any water taken up in the country—both state and private-owned—and including both surface and ground water. In determining the base of the charge for water users, the agency makes a careful distinction between making use of the water then putting it back in the ground and per-

manently removing the water from the main supply. Using principles of scarcity management, the agency as a rule levies charges on surface waters only in periods of low availability. (Harris-Wisconsin)
W77-09463

STUDY ON ECONOMIC AND POLICY INSTRUMENTS FOR WATER MANAGEMENT. WATER MANAGEMENT IN THE NETHERLANDS.

Organisation for Economic Co-Operation and Development, Paris (France).
Environment Directorate 29314, 1976. 50 p, 3 fig, 5 tab.

Descriptors: *Foreign countries, *Water management(Applied), *Water quality control, *Water policy, *Pollution taxes(Charges), Water resources development, Regulation, Management, Water law, Water allocation(Policy), Administration, Economics, Sea walls, Shore protection, Saline water intrusion, International commissions.
Identifiers: *Netherlands.

As part of a study of national policies and systems for water management in eight member countries of the Organization for Economic Cooperation and Development, the problems, management policy instruments and institutional framework of water management in Netherlands are analyzed. The country is characterized as a whole by salt intrusion into the groundwater because of the unique below-sea level situation of the artificially-built polder system. Much of the nation's water planning involves continued work on the long-term project of reclaiming land from the sea around the IJssel-lake (the former Zuiderzee). Water quality control is conducted through the Surface Waters Pollution Act of 1969 which aims at reducing such pollution to negligible proportions by 1965. In the initial phase, attention is mainly focused on oxygen-consuming pollutants. To attain this aim, taxes are being raised by both the national government and by regional authorities. The former uses income from the levies to issue grants to regional authorities and industries. Local water boards charge the individual polluters the costs of using their treatment plants. As a result of the taxes, many polluters have significantly reduced their waste water discharges into surface waters. (Harris-Wisconsin)
W77-09464

POLLUTION OF THE INTERSTATE AND INTRASTATE WATERS OF THE UPPER MISSISSIPPI RIVER AND ITS TRIBUTARIES.

For primary bibliographic entry see Field 5G.
W77-09529

FEDERALISM AND THE DEVELOPMENT OF OUTER CONTINENTAL SHELF MINERAL RESOURCES.

Miami Univ., Fla. School of Law.
R. Breeden.
Stanford Law Review, Vol 28, p 1107-59, July 1976.

Descriptors: *Oil, *Federal government, *Political aspects, *Continental shelf, *California, State governments, Offshore platforms, Coasts, Oil spills, Oil fields, Exploitation, Oil industry, Water pollution, Submerged Lands Act, Environmental effects, Ecology, Nonstructural alternatives, Planning, Legal aspects, Legislation, Water law, Water policy, Constitutional law.
Identifiers: *Outer continental shelf, *National Environmental Policy Act, *Coastal Zone Management Act of 1972, *Federal Water Pollution Control Act Amendments of 1972, Minerals, Territorial seas(Jurisdiction), Territorial waters, Coastal zones, Environmental impact statement, Marine environment.

Development of the vast petroleum reserves of the Outer Continental Shelf (OCS) by oil lease sales

generates great amounts of revenue for the federal government, but the states, as owners of many areas of the coastal land mass, bear the brunt of the problems of cost and of adverse environmental effects. Local interests, to the extent they are denied participation in planning the exploitation of offshore oil, can be expected to try to impede federal plans for rapid development of these resources. The article analyzes the sources of state power—proprietary, the police powers, and statutory—in relation to the federal powers and examines areas where the states can use court litigation to obstruct federal plans. Reliance on the judiciary as a channel for political input and for redress would be unwise, as it would create a checkerboard of conflicting adjudications, not to mention the costs in terms of time and money. With the aim of achieving the dual national goals of energy production and protection of the coastlines, the author makes proposals which would increase state decisionmaking at the initial stages and make the resource bureaucrats in the various federal departments more accountable to the political process. (Jones-Florida)
W77-09531

FLOODPLAIN ZONING—AN ALTERNATIVE APPROACH TO LAND REGULATION IN FLOOD HAZARD AREAS: A CASE STUDY, KALAMAZOO, MICHIGAN.

For primary bibliographic entry see Field 6F.
W77-09532

LAND USE CONTROL IN THE COASTAL ZONE: THE DELAWARE EXAMPLE.

Natural Resources Law Inst. Portland, Oreg.
For primary bibliographic entry see Field 6F.
W77-09533

REGULATING DEVELOPMENT ALONG THE CALIFORNIA COAST.

California Univ., Davis. Environmental Studies Program.
For primary bibliographic entry see Field 4A.
W77-09534

THE ROLE OF IRRIGATION IN FOOD PRODUCTION.

Food and Agriculture Organization of the United Nations, Rome (Italy). Land and Water Development Div.
For primary bibliographic entry see Field 3F.
W77-09535

SECTION 1424(E) OF THE SAFE WATER DRINKING ACT: AN EFFECTIVE MEASURE AGAINST GROUNDWATER POLLUTION.

For primary bibliographic entry see Field 5G.
W77-09536

FEDERAL COMMON LAW UNDER 1331(A) (COMMENT ON ILLINOIS V CITY OF MILWAUKEE).

H. S. Abrahams.
Nebraska Law Review, Vol 52, No 2, p 301-07, 1973.

Descriptors: *Common law, *Illinois, *Federal jurisdiction, *Wisconsin, Judicial decisions, Water pollution, Lake Michigan, Legal aspects, Penalties(Legal), Water law, State jurisdiction, Abatement, Legislation, Interstate, Lakes.
Identifiers: *Injunctive relief, *Federal Water Pollution Control Act (FWPCA) Amendments of 1972, Nuisance(Water law), Federal common law, Interstate waters.

In this casenote the author discusses the Court's holding in the named case that there is a federal common law of pollution, and that the federal district courts have jurisdiction over suits arising under that common law. The holding was a result

of the state of Illinois' attempt to invoke the original jurisdiction of the Supreme Court to issue an injunction against instrumentalities of the state of Wisconsin. The allegation was that four cities and two local sewerage commissions of Wisconsin were unlawfully polluting Lake Michigan. The Court denied the motion to file but remitted the parties to an appropriate district court. The Court observes that Congress has enacted many statutes regulating the pollution of interstate waters, and reasoned that the pollution of ambient air or interstate waters was an area where federal, not state, law would govern. The commentator considers that the application of the holding may be limited to suits involving governmental parties or to suits in equity, but that such limitations would be improper in view of the broadly stated pronouncements in the Illinois opinion. (Jones-Florida)

W77-09537

ANALYTIC VARIABILITY: IMPLICATIONS FOR PERMIT COMPLIANCE,

For primary bibliographic entry see Field 5G.
W77-09538

NEW OPPORTUNITIES FOR STATE PARTICIPATION IN THE CONTROL OF RADIOACTIVE POLLUTION,

For primary bibliographic entry see Field 5G.
W77-09539

EVOLUTION OF COASTAL STATE JURISDICTION: A CONFLICT BETWEEN DEVELOPED AND DEVELOPING NATIONS,

Goettingen Univ. (West Germany). Institut fuer Voelkerrecht.
E. K. Martens.
Ecology Law Quarterly, Vol 5, No 3, p 531-553 (1976).

Descriptors: *Treaties, *United Nations, *Law of the sea, *Continental shelf, United States, Governments, Oceans, Fisheries, International law, International waters, Jurisdiction, Navigation, Marine fisheries, Oil, Straits, Bodies of water, Foreign countries.

Identifiers: *Coastal states, *Marine resources, *Territorial seas, *Mineral resources, *Seabed.

For more than 300 years commentators have debated whether oceans or parts of them may be appropriated or reserved for the exclusive use of particular nations. The generally accepted limit for territorial waters was three miles, with some nations claiming as much as a 12 mile limit, until World War II, when the United States, followed by several Latin American nations, extended territorial control of marine resources to the limits of the continental shelf. Successive declarations of other states extended their own coastal claims both in distance and scope. At this time some nations claim sole sovereignty over 'territorial seas' for 200 miles, despite the efforts of the United Nations to establish uniform jurisdictional limits for all coastal states. Three conferences on the law of the sea have failed to arrive at a workable mechanism for enforcement and adjudication of international law, or even a consensus as to what the law should be. Prospects of reaching agreement among the numerous states involved are complicated considerably by the disparity of interests between the developed nations and the developing nations; the author summarizes the status of the law of the sea as of the end of the Third Conference. (Sloan-Florida)

W77-09541

PETROLEUM LEGISLATION IN THE NORTH SEA COUNTRIES,

M. H. Brenscheidt.
Texas International Law Journal, Vol 11, No 2, p 281-303 (1976).

Descriptors: *Foreign countries, *Oil fields, *International waters, *Exploration, Oil, Oil industry, Exploitation, Legal aspects, Boundary disputes, Boundaries(Property), Water law, Water rights, Off-shore platforms, Pipelines, Legislation, Continental shelf, Oceans, Drilling, Oil wells, Jurisdiction.

Identifiers: *North Sea, Denmark, Netherlands, Norway, Great Britain, Licenses.

The most recent developments in the field of exploitation of treasures of the sea have occurred in the offshore mining of minerals. This offshore mineral extraction has raised national and international legal, political, economic and technological problems. The author discusses the petroleum legislation and licensing policies of five North Sea countries: Denmark; the Federal Republic of Germany; the Netherlands; Norway; and the United Kingdom. Despite the short twelve year history of West European off-shore petroleum legislation, both legislative and licensing policies have been subject to variations and remarkable changes, particularly in countries with a high probability of success in producing oil. While the boundary disputes in the North Sea have been settled, new international legal questions have recently arisen. For the first time a giant oil field has been discovered which extends across an international boundary in the sea. The plans for this well, which stretches from Norwegian to British waters, must be determined in a spirit of cooperation by the countries involved. (Rieck-Florida)

W77-09542

WATER LAW - WELL PERMITS - UNAPPROPRIATED WATER AND MAXIMUM UTILIZATION, HALL V. KUIPER, 510 P.2D 329 (COLO. 1973),

For primary bibliographic entry see Field 6D.
W77-09543

CLEAN AIR EQUALS DIRTY WATER,

Los Angeles Dept. of Public Works, Calif.
For primary bibliographic entry see Field 5G.
W77-09544

WATER POLLUTION CONTROL FEDERATION SPEAKERS ZERO IN ON POLLUTION CONTROL LAW,

For primary bibliographic entry see Field 5G.
W77-09546

THE LEGAL IMPLEMENTATION OF COASTAL ZONE MANAGEMENT: THE NORTH CAROLINA MODEL,

North Carolina Univ. at Chapel Hill. School of Law.
T. J. Schoenbaum, and R. H. Rosenberg.
Duke Law Journal, Vol 1976, No 1, p 1-37 (March 1976).

Descriptors: *North Carolina, *Land use, *Zoning, *Land management, Legal aspects, Regulation, Local governments, State governments, Federal government, Administrative agencies, Project planning, Land, Land classification, Land development, Land resources, Parks, Recreation, Conservation, Land appraisals, Governmental interrelations, Permits, Political aspects, Social aspects.

Identifiers: *Coastal Zone Management Act, *North Carolina Coastal Area Management Act, *North Carolina Environmental Policy Act, Transferable development rights, Land banking, Land conservancy trust, Planned unit development, Coastal zone management.

North Carolina has recently developed a coastal zone management program in response to the federal Coastal Zone Management Act of 1972. The problems in North Carolina's program are typical, even though its program is more advanced than most states. New coastal management laws

will founder if the legal mechanisms for implementation are inadequate. Implementation requires a land use guidance system which incorporates the concept of carrying capacity of natural resources with the more traditional planning tools, with an eye toward coordination and efficient use. Zoning regulations should consider environmental consequences. No variances should be granted unless it can be demonstrated that such variance would not be detrimental to the environment. A system of planned unit development should also be implemented, allowing the clustering of all structures zoned out of other areas. Before projects are begun, the developer should submit an environmental impact statement. This will allow the zoning commission to ascertain the total impact, and thereby plan more prudently for the future. Presently developers must comply with federal, state and local law, and often obtain a permit from each. A coordinated effort by all levels of government would aid in comprehensive planning. Finally, preferential tax treatment could be utilized to discourage development in certain areas and encourage it in others. (Moorhouse-Florida)

W77-09547

SOME LEGAL ASPECTS OF THE ATLANTIC LOBSTER INDUSTRY,

North Carolina Univ. at Chapel Hill. School of Law; and North Carolina State Univ., Raleigh. Sea Grant Coll. Program.
E. L. Winn, III.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-246 878, Price codes: A02 in paper copy, A01 in microfiche. Sea Grant Program, North Carolina State University, Raleigh, Publication UNC-SG-75-07, July 1975. 15 p.

Descriptors: *Federal government, *Lobsters, *Regulation, *International waters, Shellfish, Commercial shellfish, Treaties, Maine, Massachusetts, North Carolina, Governments, Fishing, Commercial fishing, Trawling, Fishing gear, Nets, Boundary disputes, Continental shelf, Continental slope, New England.

Identifiers: *Lobster pots, *Coastal zone.

Lobsters are the second most valuable species in the United States fishing industry, and there is evidence that the world market is increasing. Lobster fishing is regulated by each state within its three mile limit, but there are no restrictions on the exploitation of the off-shore catch, which has been developing since the late 1950's. The offshore lobster fishery is found largely on the continental shelf and slope, up to over one hundred miles out. There is little recognized law in the area, and as a result a significant lack of restrictions for the offshore industry. A major problem for United States lobster fishermen is the extensive damage which occurs to 'fixed gear' - stationary lobster pots - when trawling vessels, often from foreign nations, drag their weighted nets through lobster grounds while seeking free-swimming schools of fish. There are some agreements in force between the United States and other countries whose vessels travel in the lobster grounds of the U.S. continental shelf in regard to damages done to lobster pots, but for the most part, the aggrieved lobsterman must prove tortious conduct on the part of the trawling vessel in order to recover for damaged gear. (Sloan-Florida)

W77-09548

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES: JULY-SEPTEMBER 1975.

Nuclear Regulatory Commission, Washington, D. C.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 033, Price codes: A02 in paper copy, A01 in microfiche. March 1976. 15 p.

Descriptors: *Nuclear powerplants, *Nuclear energy, *Administrative agencies, *Accidents,

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Group 6E—Water Law and Institutions

*Hazards, Safety, Federal government, Legislation, Social aspects, Public health, Radioactivity effects, Radioactivity, Industrial plants, Permits, Regulation, Management, Nuclear engineering, Nuclear reactors, Safety factors, Nuclear physics. Identifiers: *Abnormal occurrences, *Energy Reorganization Act of 1974, Atomic Energy Act of 1954, Licenses.

The Energy Reorganization Act of 1974 established the Nuclear Regulatory Commission. Section 208 of the Act required the Commission to submit to Congress each quarter a report listing any abnormal occurrences at, or associated with, any facility which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954 or the Energy Reorganization Act of 1974. An abnormal occurrence is an unscheduled incident or an event which the Commission determines is significant from the standpoint of public health or safety. Each report must include the date and place of the occurrence, nature and probable consequence, cause or causes and any action taken to prevent recurrence. This is the second report to Congress on abnormal occurrences. It includes the results of a review of events at nuclear power plants for the third quarter of 1975 and the results of a review for overexposure to radiation at all licensed facilities for a nine-month period. Results indicate that there were no abnormal occurrences at licensed nuclear power plants during the period and additionally no abnormal occurrences involving exposure to radiation were detected from January 1 to September 30, 1975. Consequently, the report focuses mainly on information concerning events reported to Congress in the first report dated October, 1975. (Moorhouse-Florida) W77-09549

BENEFIT-COST ANALYSIS: ITS USE (MISUSE) IN EVALUATING WATER RESOURCE PROJECTS.
For primary bibliographic entry see Field 6B.
W77-09550

ARTIFICIAL WATER REGULATION OF LAKE SUPERIOR—A TAKING.
Washington Coll. of Law D. C.
D. Palmer.
Environmental Law, Vol 6, No 2, p 357-86 (1975).

Descriptors: *Lake Superior, *Great Lakes Region, *Water control, *Flood damage, *Regulated flow, Damages, Regulation, Water storage, Water management (Applied), Water injury, Water levels, Flooding, Water distribution (Applied), Lakes, Great Lakes, High water mark.
Identifiers: *Taking, *Artificial water regulation.

The shorelines of Lake Superior experienced severe inundation and erosion damages due to record high water levels caused by extreme amounts of precipitation between 1971 and 1975. In an effort to mitigate damages in the lower Great Lakes, the United States and Canada requested the International Joint Commission (IJC) to store water in Lake Superior by reducing its discharge thus allowing less water to escape from Lake Superior through the lower lakes. Consequently, near all-time high water levels of Lake Superior have caused impairment and erosion of portions of private shoreline property. This situation presents complex legal problems: first, the fifth amendment to the United States Constitution prohibits the government from an uncompensated deprivation of private property. The author suggests that injured Lake Superior property owners may, therefore, be entitled to compensation of their loss under the theory of eminent domain. Second, an international law issue is whether the IJC violated the Boundary Waters Treaty by allowing the United States to raise the water levels without first approving an adequate compensation plan. After analyzing these issues, the author concludes that the possibilities are slight that a litigant could successfully vindicate his or her rights in court

because the costs would be prohibitive and the Great Lakes present such a unique controversy. The only solution to the problems now under consideration is an amendment to the Coastal Zone Management Act of 1972, but it represents an incomplete resolution. (Joseph-Florida)
W77-09551

NEW ROLES FOR THE OLD DAM BUILDERS.
National Wildlife Federation, Washington, D. C.
General Counsel Office.
For primary bibliographic entry see Field 6F.
W77-09552

WHAT ARE WE DOING ABOUT OIL SPILL.
For primary bibliographic entry see Field 5G.
W77-09553

EFFLUENT STANDARDS: TRIALS AND TRIBULATIONS.
For primary bibliographic entry see Field 5G.
W77-09554

THE NEED FOR A NATIONAL OCEAN PROGRAM AND PLAN.
GAO Report to Congress, The Need for a National Ocean Program and Plan, 75 p, October, 1975. 1 fig, 2 chart, 11 appendix.

Descriptors: *Oceans, *Federal government, *Resources, *Administrative agencies, Ecology, Ecosystems, Oceanography, Marine geology, Fish, Natural resources, Transportation, Energy, Recreation, Economics, Costs, Benefits, Resources development, Oil.
Identifiers: *Marine resources, *Ocean policy, *Interagency Committee on Marine Science, Engineering and Resources, Minerals.

The oceans play a vital role in the Nation's welfare, economic self-sufficiency, and national security. Consequently, a concerted effort should be made to establish a comprehensive national ocean program. The urgent need for such a program is the focus of this report. Included are discussions of: The National Ocean Study Policy; the establishment of the National Oceanic and Atmospheric Administration; other federal agencies' participation in marine sciences and oceanic affairs; numbers and kinds of projects undertaken; amounts of funds allocated to these activities for various years; and an evaluation of these activities. Although Congress formally recognized the need for a national ocean program with the passage of the Marine Resources and Engineering Development Act of 1966, there is still no comprehensive ocean program. Three agencies have been created to consider national policy in this area, but none have been given the authority to see that its recommendations were implemented. One of these, the Interagency Committee on Marine Science, Engineering, and Resources, has been unable to determine (in the eight years since its creation) whether federal resources have been used effectively or efficiently in the areas of marine sciences and ocean affairs. (Sloan-Florida) W77-09555

EFFLUENT GUIDELINES AND STANDARDS, PULP, PAPER AND PAPERBOARD POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W77-09556

EFFLUENT GUIDELINES AND STANDARDS, PHOTOGRAPHIC POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W77-09557

EFFLUENT GUIDELINES AND STANDARDS, STEAM ELECTRIC POWER GENERATING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W77-09558

EFFLUENT GUIDELINES AND STANDARDS, THE ORGANIC CHEMICALS MANUFACTURING POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D. C.
For primary bibliographic entry see Field 5G.
W77-09559

PERMIT PROGRAM REGULATIONS FOR AGRICULTURAL ACTIVITIES, (NPDES), (PROPOSED).
Environmental Protection Agency, Washington, D. C.
Federal Register, Vol 41, No 36, p 7963-66, February 23, 1976.

Descriptors: *Permits, Agriculture, *Agricultural runoff, *Regulation, Federal Water Pollution Control Act, Rainfall-runoff relationships, Surface runoff, Forest management, Federal government, Administrative agencies, Legal aspects, Water pollution sources, Water pollution control, Legislation, Water pollution, Forestry, Forest soils, Pollutants, Pollution, Surface waters, Irrigation canals, Irrigation, Irrigation ditches.
Identifiers: *Administrative regulations, National Pollutant Discharge Elimination System, Certification, Point sources (Pollution), Non-point sources (Pollution).

The Environmental Protection Agency (EPA) has proposed regulations applying the National Pollutant Discharge Elimination System (NPDES) permit program to point source discharges in the agriculture and silviculture categories. Discharges of pollutants into navigable waters through discrete conveyances which results from the controlled application of water are considered agricultural activity point sources. Irrigation return flow ditches are the most common examples. Discharges are to be governed by general permits which will be issued following notice and an opportunity for a hearing. The intent of the regulations is to exclude from the permit program all natural runoff from agricultural land which results from precipitation events and is therefore nonpoint in nature. The agricultural and silviculture point source regulations are issued in compliance with a court order in NRDC v. Train. The EPA has taken an appeal of this case and therefore the final status of the proposed regulations is as yet unknown. (Moorhouse-Florida) W77-09560

COUNTY OF ORANGE V. CHANDLER-SHERMAN CORPORATION (IMPLIED PUBLIC DEDICATION OF PRIVATE LAND THROUGH SUBSTANTIAL AND CONTINUOUS USE).
126 Cal. Rptr. 765-70 (Cal. App. 1976).

Descriptors: *California, *Public rights, *Implied benefits, *Recreation demand, *Beaches, Public access, Right-of-way, Recreation, Recreation facilities, Legal aspects, Land use, Adverse possession, Real property, Competing uses, Shores, Relative rights.
Identifiers: *Public use, *Public dedication, *Implied dedication, *Implied use, Landowners.

The county brought suit to establish public rights to a strip of beach under the implied public dedication doctrine. The doctrine allows public use of privately-owned land if, for a five-year period, there has been such continuous and substantial use of the property in question that the owners should have realized that their acquiescence amounted to an implied gift to the public. Although neither

party to the action attempted to dispute the validity of the public dedication doctrine, the owners claimed that the use had not been substantial nor continuous enough for the doctrine to operate. To support this contention, they presented evidence to show that generally there were never more than 15 people on the beach because of the beach's relative isolation, and there was only casual as opposed to continuous use of the beach for public recreational activities. In addition, access to the beach was by means of ill-defined paths which reinforced the owner's contention that there was not a continuous volume of public traffic. The trial judge refused to find that a public dedication had taken place and the appellate court affirmed. (Denker-Florida)

W77-09561

OIL IN NEPTUNE'S KINGDOM: PROBLEMS AND RESPONSES TO CONTAIN ENVIRONMENTAL DEGRADATION OF THE OCEANS BY OIL POLLUTION.

Cummins Engine Co., Inc., Columbus, Ind.
For primary bibliographic entry see Field 5G.
W77-09562

STATE WATER RESOURCES CONTROL BOARD V FORNI (RIPARIAN RIGHTS DOCTRINE MODIFIED BY CONSTITUTIONAL PROVISION).

126 Cal Rptr 851-58 (Cal App 1976).

Descriptors: *California, *Riparian rights, *River regulation, *Water rights, Rivers, River flow, Frost, Diversion, Pumping, Beneficial use, Regulation, Water allocation(Policy), Reservoirs, Appropriation, Riparian waters, Legislation, State governments, Relative rights, Administrative agencies.

Identifiers: *Property interests, *Injunctive relief, Declaratory judgment, Napa Valley.

Plaintiff board brought action for injunction and/or declaratory relief against defendant vineyardists. Plaintiff sought to enjoin defendants from drawing water directly from the Napa River to protect the vineyards from frost. The plaintiff alleged that the direct diversion of water during a frost period constituted an unreasonable use since during this time the river flow is insufficient to supply the needs of all who are entitled to water. Defendants claimed that because they were riparian owners the plaintiff had no authority to prohibit or limit their use of water. The lower court gave judgment on the pleadings to the defendants. The appellate court reversed, holding that because of a constitutional provision modifying the riparian doctrine, the complaint was sufficient to state a cause of action. The present doctrine requires a reasonable use between riparian owners and others, including appropriators. The appellate court held that the judgment on the pleadings was insufficient to determine the question of reasonable or unreasonable water use. In addition, the court noted that while defendants' argument that vested property rights cannot be taken without just compensation was correct, the vested rights theory was not applicable to the present case. (Petruff-Florida)

W77-09563

MORSHED V CALIFORNIA REGIONAL WATER (WATER QUALITY STANDARDS UPHOLD AS A VALID EXERCISE OF POLICE POWER).

119 Cal Rptr 586-90 (Cal App 1975).

Descriptors: *California, *Water pollution, *Sewage disposal, *Water quality control, Legal aspects, Administrative agencies, Sewage districts, Sewage treatment, Sewage, Water pollution sources, Disposal, Waste disposal, Governments, Discharge(Water), Water law, Waste treatment, Environment, Public rights, State governments, Judicial decisions.

Identifiers: Inverse condemnation, *Water codes, *Effluent guidelines, Environmental policy, Evidence, Notice, Property interests, Administrative regulations.

Plaintiffs brought an action for mandamus to restrain the enforcement of certain cease and desist orders issued by the defendant Board. Pursuant to section 13263 of the Water Code, the defendant adopted water quality requirements for waste discharges which are pumped indirectly into the San Francisco Bay. These discharges are placed into the bay by district or municipal dischargers who operate sewage treatment plants. Cease and desist orders were issued by the defendant to three municipal dischargers who were found in violation of the water quality requirements. The defendant ordered the dischargers to refrain from further violations and prohibited the districts from authorizing any further connections to their sewage treatment facilities pending corrective measures. As a result the plaintiffs were prohibited from using their properties in a manner which would require a sewer connection. The lower court rendered judgment for the defendant. The appellate court affirmed, finding that the plaintiffs had been given sufficient notice of the hearing, had an opportunity to cross-examine and refute the defendant's evidence, and that the issuance of the order was a reasonable exercise of the state's police power. In addition, the orders were held not to constitute inverse condemnation of the properties. (Petruff-Florida)

W77-09564

NAVAJO TERMINALS, INC V SAN FRANCISCO BAY CONSERVATION AND DEVELOPMENT COMMISSION (SHORELINE REGULATORY PLAN DID NOT CONSTITUTE A TAKING OF PROPERTY).

120 Cal Rptr 108-10 (Cal App 1975).

Descriptors: *California, *Administrative agencies, *Boundary disputes, *Shores, State governments, Legal aspects, Judicial decisions, Condemnation, Boundaries(Property), Legislation, Planning, Project planning, Water law, Administrative decisions, Canals, Local governments, Coasts.

Identifiers: *Tidal canal, *Coastal zone management, Inverse condemnation, Coastal zones, Property, Property interests, McAteer-Petris Act.

Plaintiff property owner brought action against defendant commission alleging that defendant's resolution establishing portions of plaintiff's property as a waterfront park constituted inverse condemnation. The lower court sustained defendant's demurrer and dismissed the action. The plaintiff appealed. The defendant commission was created by the McAteer-Petris Act. This Act contemplates adoption of a general plan to analyze, plan, and regulate the San Francisco Bay and its shoreline. Pursuant to the Act the defendant adopted a resolution fixing and establishing within the shoreline band the boundaries of the water-oriented priority land uses. Portions of the plaintiff's property fronting on the US Tidal Canal was designed for use as a waterfront park in this resolution. Plaintiff contends that the resolution constituted a taking because the defendant had no authority to modify the plan. The appellate court affirmed the decision of the lower court because the plan was modifiable by the legislature, hence there had not as yet been a taking. (Petruff-Florida)

W77-09565

COASTAL ZONES.

Oregon Rev. Stat. secs. 191-110 thru -180 (1973).

Descriptors: *Oregon, *Legislation, *Comprehensive planning, *Administrative agencies, Future planning(Projected), Long-term planning, State governments, Competing uses, Local governments, Governmental interrelations,

Water resources development, Management, Natural resources, Regional development, Social aspects, Economic impact.

Identifiers: *Coastal zone management, *Oregon Coastal Conservation and Development Commission, Comprehensive studies, Coastal waters.

The Oregon Legislative Assembly has recognized the state's coastal zone as a valuable part of the natural resources of the state. Additionally, the legislature has recognized a conflict among differing interests over the use of the coastal zone. Consequently, the Oregon Coastal Conservation and Development Commission has been established to manage Oregon's coastal zone. The Commission consists of representatives of four newly created coastal zone regions. The Governor shall appoint two members from each district as well as two at-large members. The remaining posts will be filled by two elective county, city and port district officials from each district. The Commission will study the natural resources of each coastal zone and recommend the highest and best uses of such resources. More specifically, the Commission will be charged with submitting a report to the Governor outlining a comprehensive plan for the preservation and development of the natural resources of the coastal zone. In preparing such a plan the Commission shall consider the quality, quantity, and movement of water, existing local land use plans and zoning ordinances, and all available economic, ecological and scientific information. (Moorhouse-Florida)

W77-09566

ISRAEL V MORTON (RESTRICTIONS ON RIGHTS OF CONVEYANCE OF PROPERTY WITHIN A FEDERAL RECLAMATION PROJECT).

549 F2d 128-33 (9th Cir 1977).

Descriptors: *Federal Reclamation Law, *Grand Coulee Dam, *Washington, *Real property, Land reclamation, Property values, Judicial decisions, Water contracts, Reclamation states, Irrigation districts, Columbia River, Water rights, Legal aspects, Water law, Farm units.

Identifiers: *Property interests, *Real property law.

Appellants, landowners within the Columbia Basin Project, sought judicial declaration of their right to sell excess land within the federal reclamation project without restriction on price and with the right for the land to receive water. The Project Act provided that for a period of five years from the time water became available for the lands covered, no conveyance of land could be made in excess of its appraised value, and if made, the right of the estate to receive water from the project works could be cancelled. The restriction was no longer in effect when appellants acquired their excess land, but later amendments to the Project Act revived the restriction. Appellants' claim was that applying the amendment to them would be a deprivation of property without due process. In holding against the landowners, the court distinguished between natural-flow water and project water with the right to the latter dependent upon the terms fixed by the United States. At the time appellants acquired their land it was subject to the terms of future amendments and supplements, so that their rights did not vest at the time of acquisition. (Jones-Florida)

W77-09567

CAMPBELL RANCH, INC. V WATER RESOURCES DEPARTMENT (GOVERNMENT AGENCY MUST COMPLY WITH NOTIFICATION PROCEDURES BEFORE DECLARING CRITICAL GROUND WATER AREA).

558 P2d 1295-98 (Or Ct App 1977).

Descriptors: *Groundwater, Administrative agencies, *Water allocation(Policy), *Irrigation wells, *Oregon, Water rights, Appropriation, Legal

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aspects, Legislation, Judicial decisions, Water resources, Water law, Prior appropriation, Preferences (Water rights), Groundwater availability, Groundwater resources, Wells, Irrigation. Identifiers: *Groundwater management, Notice, *Administrative Procedures Act (APA), Ground Water Act of 1955, Critical ground water area, Water appropriators.

Plaintiffs were water appropriators in an area which was declared by the defendant Water Resources Department to be a critical ground water area. The defendant, after making this determination, imposed restrictions on the area. These restrictions included placing a moratorium on construction of new irrigation wells and a limitation on the removal of water from existing irrigation wells. Plaintiffs appealed the order claiming that the proceedings were initiated without proper notice. The defendant relying on the Ground Water Act of 1955 claimed that notification by ordinary mail was sufficient. This Act does not stipulate that notification by registered mail is required. However, the plaintiffs claimed that the defendant is also subject to the Administrative Procedures Act. This Act (APA) requires notification by registered mail in all contested cases. A contested case is one in which individual legal rights are decided. The court found that the agency proceeding came within the meaning of a contested case and that the APA procedure should have been followed. Therefore, the court reversed and remanded the order. (Petruff-Florida)

W77-09568

WIMMER V COMPTON (ASSESSMENT OF FLOODWATER DAMAGES IN CASES INVOLVING ADJACENT LANDOWNERS).
560 P2d 626-32 (Or Sup Ct 1977).

Descriptors: *Oregon, *Flood damage, *Drainage, *Adjacent land owners, *Landfills, Floodwater, Damages, Flooding, Flood flow, Flood discharge, Flood control, Water control, Water law, Water rights, Water courses (Legal aspects), Drainage area, Drainage water, Drainage practices, Culverts.
Identifiers: *Injunction.

Plaintiff landowner sought an injunction and damages against defendant, an adjacent landowner. Defendant maintained a land fill operation on his property and plaintiff claimed that it blocked the usual course of runoff of ordinary flood waters which annually followed a natural course across defendant's land. Plaintiff claimed that defendant's landfill raised the elevation of his property and the raised elevation was the cause of flood damages to plaintiff's land. The trial court granted the injunction but refused to award damages, labelling them 'speculative'. Defendant appealed the injunction and plaintiff cross-appealed on the issue of damages. Plaintiff argued that the same rules that apply to upper and lower riparian owners (that they cannot unreasonably interrupt the natural flow of water to the detriment of the other) should apply to adjacent owners on opposite sides of a flood water course. The appellate court accepted plaintiff's premise, but affirmed the trial court's ruling because plaintiff was unable to carry his burden of proof in view of the numerous other factors (substitution of culverts for bridges, deposits of silt preventing drainage and accumulation of debris in ditches) contributing to flood conditions. (Denker-Florida)

W77-09569

PAYNE V WHITING (UPPER RIPARIAN OWNER RESPONSIBLE FOR SURFACE RUNOFF DAMAGES).
231 SE2d 796-8 (Ga Ct App 1976).

Descriptors: *Georgia, *Riparian rights, Surface runoff, *Ponding, Judicial decisions, Legal aspects, Water law, Water policy, Runoff, Pudding, Surface waters, Non-navigable waters,

Streams, Water rights, Prescriptive rights, Stream-flow, Flow, Sedimentation.
Identifiers: *Property interests, *Evidence, Sediment pond.

The defendants, upper riparian owners of a non-navigable stream, appealed from a jury verdict awarding damages to the plaintiff, the lower owner. In the original action, the plaintiff alleged that the negligent manner in which the defendants had graded and cleared their land allowed surface water to concentrate and flow onto plaintiff's property in an unnatural manner. This runoff water contaminated the plaintiff's pool with large amounts of sediment filling it to the point where it became virtually unusable. To clear the water and prevent further damage, plaintiff built a sediment pond. Plaintiff then initiated a suit to recover damages. The jury found that the defendant builders were negligent and awarded plaintiff damages in the amount of money expended to clear the pond. Defendants appealed from this verdict alleging that the wrong measure of damages was used, that inadmissible evidence was admitted, and that the trial judge erred in not giving two requested instructions to the jury. The appellate court found no reversible error and affirmed the judgement of the lower court. (Petruff-Florida)

W77-09570

CABAL V KENT COUNTY ROAD COMMISSION (REASONABLE USE OF AN EXPRESS EASEMENT).
250 NW2d 121-23 (Mich Ct App 1977).

Descriptors: *Michigan, *Right-of-way, *Overburden, *Reasonable use, Legal aspects, Judicial decisions, Real property, Littoral, Recreational facilities, Recreation, Water law, Water rights, Legal review, Riparian rights, Prescriptive rights, Lakes.
Identifiers: *Quiet title, Easements, *Adverse possession, Privileges, Exclusive use, Permissive use, Nonpermissive use.

Plaintiffs, owners of lots fronting on a road which parallels the coastline of a lake, brought suit to quiet title to a strip of land between the road and the lake's edge. The lakeside strip was used by defendants, adjacent lot owners, for boating, maintaining a dock, sunbathing and parking cars. Defendants based their argument on three theories: express easement (legal right of access on another's land), prescriptive rights through adverse possession (rights gained through open, continuous non-permissive use for a statutory period), and littoral (riparian) rights. The Michigan Court of Appeals held that plaintiffs could not claim exclusive rights in the strip and that defendants could maintain their dock and enjoy boating pursuant to their express grant of easement. It dismissed defendant's other two theories. However, the court went on to hold that defendants could only enjoy those privileges which were reasonably connected to the easement, and could not overburden the easement by using the strip for sunbathing or picnicking or parking cars. In short, defendants were only entitled to reasonable use of the easement. (Denker-Florida)

W77-09571

CAINE V CANTRELL (PRIVATE INDIVIDUALS NOT ALLOWED TO OBSTRUCT PUBLIC LANDS).
369 A2d 56-61 (Md Ct App 1977).

Descriptors: *Maryland, *High water mark, *Low water mark, *Permits, Judicial decisions, Local governments, State governments, Oceans, Legislation, Legal aspects, Water law, Building codes, Jurisdiction, Public access, Public rights, Sea level, Water levels.
Identifiers: State policy, *Property interests, *Public trust doctrine.

Appellant property owners appealed from a trial court order which declared that a parking structure erected in the bed of a public street adjacent to an ocean front lot and a house erected on the lot should be abated as public nuisances. The lower court held that the agents of the local government were without authority to grant a permit allowing a private individual to obstruct a public street. The appellate court affirmed. The lower court also concluded that the ownership of land lying between the mean high water mark and the mean low water mark is vested in the state and held in trust for public use. The house was found to extend five feet easterly of what the trial court found to be the mean high water mark. It was then ordered to be abated. The appellate court held that the trial court erred in ordering the entire structure to be removed and revised the order to include only that portion of the structure which extended beyond the mean high water mark. (Petruff-Florida)

W77-09572

PITMAN V WASHINGTON SUBURBAN SANITARY COMMISSION (ENVIRONMENTAL EFFECTS REPORTS ONLY REQUIRED FOR STATE ACTIONS).

368 A2d 473-78 (Md Ct App 1977).

Descriptors: *Sludge disposal, *Judicial decisions, *Administrative agencies, *Environmental effects, *Maryland, Legislation, Legal aspects, Appropriation, Economics, Local governments, State governments, Cases, Water law, Legal review, Government finance, Sludge treatment, Sludge, Sewage, Sewage treatment.
Identifiers: Administrative regulations, Environmental policy, State policy, Environmental effects report.

Plaintiffs, persons residing in the vicinity of a proposed sludge disposal site, brought action to enjoin the defendant Commission from purchasing the site. The plaintiffs alleged that no environmental effects report had been prepared as required by the Maryland Environmental Policy Act. Under the Act a report must be prepared for each proposed state action that will significantly affect the environment. The Act defines state action as requests for legislative appropriations or other legislative actions that will alter the quality of the air, land, or water. The court held that the Act referred only to action taken by the state legislature and that the fact that there existed a relationship between the proposed site and a state funded sewage treatment plant was insufficient to establish state action. Accordingly, the court held that the Commission was not required by the Act to prepare a report since it had made no request to the state legislature for the site purchase price or for other action. Furthermore the court found that appropriation requests made to local governing bodies would not make the requirements of the Act operative. (Petruff-Florida)

W77-09573

LANSCO, INC. V DEPARTMENT OF ENVIRONMENTAL PROTECTION (INSUROR'S LIABILITY FOR COST OF CLEAN UP OF OIL SPILLS).
368 A2d 363-64 (NJ Super Ct App Div 1977).

Descriptors: *New Jersey, *Oil spills, *Cleaning, *Insurance, Acts of God, Judicial decisions, Water law, State governments, Water quality, Water pollution control, Oil industry, Legal aspects, Protection, Oil pollution, Regulation.
Identifiers: *Hazardous substances, Liability.

Defendant insurance companies appealed the decision of the Superior Court of New Jersey, Chancery Division, that it indemnify its insured for costs incurred in cleaning up oil spillage. The insured was legally liable for the cost of clean-up under the New Jersey Water Quality Improvement Act of 1971. In the appeal, the insurer sought to establish that if the discharge was due to acts of third parties or vandals, that would be an excep-

tion to liability under the statute. The Appellate Division held that this would not be an exception to liability, the only two exceptions to liability for discharge of petroleum products being those which occur as a result of (a) an act of war, or (b) an act of God. The court thus affirmed the finding of the insurer's liability. (Jones-Florida) W77-09574

ALTERATION OF CHANNEL OF STREAMS (PERMIT SYSTEM).

Idaho Code Ann secs 42-3801 thru -3810 (Supp 1976).

Descriptors: *Idaho, *Streams, *Water quality control, *Wildlife conservation, Fish conservation, Environmental control, Aesthetics, Recreation, Degradation(Stream), Surface-groundwater relationships, Law enforcement, Regulation, Channels, Water pollution control, Water pollution effects, Water policy, Wildlife habitats.

The stream channels of the state of Idaho and their environments shall be protected against alteration for the preservation of the fish and wildlife habitat, aquatic life, recreation, aesthetic beauty and water quality. Before engaging in any project which may alter a stream channel, an application, accompanied by plans, must be submitted to the state's department of water resources. After consulting with other state agencies, the department director must determine the likely effect of the proposed alteration on the stream channel's environment. If the applicant is dissatisfied with the director's decision regarding the application, he may appeal to the state water resources board for final review. No permit is required to clean or repair stream channels, canals, ditches, or laterals. Reservoirs and port districts are exempt from the act. When emergencies require immediate action, the director may waive the provisions of the act. Violators are guilty of a misdemeanor and may be punished by fine. Any unauthorized channel alteration may be declared as public nuisance and subject to abatement. (Rieck-Florida) W77-09575

PRESERVATION OF CERTAIN LAKES AS HEALTH RESORTS AND RECREATION PLACES.

Idaho Code Ann secs 67-4301 thru -4312 (1948), as amended (Supp 1976).

Descriptors: *Idaho, *Recreation, *Lakes, *Reservoirs, *Appropriation, Recreation facilities, Scenery, Social aspects, Social needs, Water law, Legal aspects, Aesthetics, Preferences(Water rights), Priorities, Legislation, Public health, Public benefits, Social values.
Identifiers: Priest Lake, Pend d'Oreille Lake, Coeur d'Alene Lake, Big Payette Lake, Thousand Springs.

The governor of Idaho may appropriate in trust all the unappropriated water of Big Payette Lake, or so much as may be necessary to preserve the lake in its present condition. The lands between the high and low water marks at the lake are to be used as a recreation place, and not as a storage reservoir for irrigation or power purposes. The unappropriated water of Priest, Pend d'Oreille and Coeur d'Alene Lakes may also be held in trust for the state's citizens for health and recreational purposes. Certain described portions of Malad Canyon, Niagara Springs, Big Springs and Box Canyon are to be used for the same purposes. Upon cessation of the use of waters in Thousand Springs for electrical generation, the Springs shall be preserved for their scenic beauty. The permits for all of the described waters shall be issued by the director of the department of water resources after the determination of the historical waterflow. Any future appropriation of the specifically described waters that are granted above the designated flow limits shall not involve any diversion that shall detract from the geological value, historical significance or scenic attraction of the lands. (Rieck-Florida)

W77-09576

STATE OF FLORIDA V FLORIDA NATIONAL PROPERTIES, INC. (RIPARIAN BOUNDARIES IN MEANDERED, FRESH-WATER LAKES).

338 So2d 13-21 (Fla 1976).

Descriptors: *Florida, *Boundaries(Property), *High water mark, Accretion(Legal aspects), Ownership of beds, Riparian rights, Riparian land, State governments, Land tenure, Legal aspects, Surveys, Patents, Adjacent land owners, Shores, Real property.
Identifiers: *Reliction, *Property interests.

Plaintiff, an owner of lands bordering a navigable lake, sought to quiet title to property alleged by the state to be sovereignty bottom lands under a statute setting boundaries of such lands as of the date of statehood. The boundary claimed by the state included approximately half of plaintiff's purchased property. The state alleged that the lake level had been artificially lowered by drainage conducted by surrounding property owners. Plaintiff contended that any lowering of the lake was legally reliction, and that the boundary was the present ordinary high water line. The Supreme Court of Florida found the application of the statute to establish the boundary as of the date of statehood unconstitutional, noting that access to water is often the most valuable feature of riparian property. The court also observed that operation of the statute would deny the plaintiff due process by taking the land without payment of just compensation. Furthermore, the property line separating sovereignty and riparian property rights is the ordinary high-water mark in meandered fresh-water lakes. (Molloy-Florida)

W77-09577

TANNERS' COUNCIL OF AMERICA V TRAIN (REVIEW OF EFFLUENT LIMITATIONS FOR TANNING INDUSTRY).

540 F2d 1188-95 (4th Cir 1976).

Descriptors: *Federal Water Pollution Control Act, *Tannery wastes, *Standards, *Administrative agencies, Industrial wastes, Waste water treatment, Federal government, Permits, Effluents, Administrative decisions, Technology, Decision making, Legal review, Water pollution sources, Regulation.
Identifiers: *Federal Water Pollution Control Act Amendments of 1972.

Plaintiff trade association of leather tanners brought action to set aside regulations establishing effluent limitations guidelines and standards of performance for industry point source categories, issued by the Administrator of the Environmental Protection Agency (EPA) under the Federal Water Pollution Control Act (FWPCA). Plaintiff alleged that the EPA was not authorized to set effluent limitations, and that the regulations were arbitrary and capricious due to technical errors made in the rulemaking process. The court noted that authorization to set the limitations had already been upheld, and that the EPA had to show all grounds relied on during the rulemaking process. In considering the limitations, which imposed a transfer of technology from the meat packing industry to the tanning industry, the court failed to find any evidence in the record showing reasonableness of the reduction levels. Failure to consider reduction of efficiency in low temperatures was also noted by the court. Because of the statutory requirement for continuing EPA review, the 1983 limitations were upheld, while the 1977 limitations standards were remanded to the EPA for reconsideration. (Molloy-Florida)

W77-09578

CPC INTERNATIONAL, INC V TRAIN (REVIEW OF EFFLUENT LIMITATIONS FOR THE CORN WET MILLING INDUSTRY).

540 F2d 1329-45 (8th Cir 1976).

Descriptors: *Water quality standards, *Industrial wastes, *Waste water treatment, *Federal government, *Administrative agencies, Federal Water Pollution Control Act, Permits, Standards, Decision making, Effluents, Food processing industry, Legal review, Administrative decisions, Cost analysis, Estimated costs, Technology.
Identifiers: *Federal Water Pollution Control Act Amendments of 1972, Administrative regulations, Corn wet milling industry.

Petitioner representatives of the corn wet milling industry sought review of regulations promulgated by the Environmental Protection Agency (EPA) setting forth standards of effluent discharges for new plants under the Federal Water Pollution Control Act Amendments of 1972. The standards had been remanded to the EPA in a prior case with instructions either to furnish support for the standards or to establish new ones. Petitioners alleged that the EPA had failed to fairly reconsider the standards, that the 1977 standards could not be met by proposed new technology, and that the EPA had erred in determining projected cost figures of compliance. The court found that the EPA had made a serious effort to obtain available information on the standards, and upheld all new source standards except for BOD5 and TSS maximum averages of daily effluent values. Neither capital costs nor recovery and operating costs were shown to be arbitrary. The case was remanded to the EPA with instructions to revise the excepted standards within 60 days, with the court again to review if lower standards were adopted. (Molloy-Florida)

W77-09579

UNITED STATES V COMMODORE CLUB (CRIMINAL PENALTY FOR FILLING VIOLATION).

418 F Supp 311-23 (E D Mich 1976).

Descriptors: *Michigan, *Penalties(Legal), *Law enforcement, *Rivers and Harbors Act, *Navigation, Legislation, Permits, Federal government, Administrative agencies, Landfills, Federal jurisdiction, Regulation, Navigable waters, Lakes, Riparian rights, Judicial decisions.
Identifiers: *Fill permits, Navigational obstructions, Navigability tests.

Corporate and individual defendants were tried in criminal prosecution for violating the Rivers and Harbors Act of 1899, which prohibits the construction of any obstruction of navigable waters without prior authorization. The defense alleged that the prosecution failed to prove that navigable waters were involved, that authorization was not obtained, and that the requisite intent was present. Defendants had purchased swampy land for development, and applied for a permit from the Corps of Engineers. A final draft permit was sent by the Corps before compliance with prerequisites, and the defendants admittedly began filling. The court held that while the final draft permit might equitably prevent the Corps from enjoining further activity, the criminal statute requires a valid permit, which was not issued. The court considered the history of the property in question, past uses, and extent of recent flooding to determine that the government had not proved to the necessary degree of certainty that the waters were navigable. Considering the penalties imposed, uncertainty of the Corps' jurisdiction, and availability of injunctive remedies, the court held that general intent to violate the Act must be established for criminal conviction, and that the defendants were, therefore, not guilty. (Molloy-Florida)

W77-09580

HILL V TENNESSEE VALLEY AUTHORITY (APPLICATION OF ENDANGERED SPECIES ACT TO FEDERAL PROJECT).

419 F Supp 753-64 (E D Tenn 1976).

Field 6—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Descriptors: *Tennessee Valley Authority, *Dams, *Fish, *Environmental effects, *Aquatic habitats, Fish establishment, Habitats, Legislation, Budgeting, Administration, Federal government, Federal project policy, Tennessee River, Wildlife conservation.
Identifiers: *Snail darter.

Plaintiff environmental groups sought to enjoin completion of a dam by the Tennessee Valley Authority (TVA) by alleging violation of the Endangered Species Act (ESA). ESA provides in part that all federal departments and agencies shall insure that their actions do not jeopardize the existence of endangered species. The species so endangered by the dam was the snail darter, a small fish whose primary habitat was the river being dammed. The court agreed with plaintiffs' allegation that completion of the dam would result in modification or destruction of the snail darter's critical habitat. In determining whether ESA required that an injunction be issued to prevent completion of the project, the court considered the record of Congressional funding of the project, the fact that authorization for the project predated by ESA by seven years, and the absence of reasonable modifications that would insure compliance with ESA. The court concluded that ESA would not operate in such a manner as to halt the completion of this particular project. (Molloy-Florida)
W77-09581

STATE V OROVILLE-WYANDOTTE IRRIGATION DISTRICT (INHERENT DUALITY OF THE FEDERAL POWER ACT).

411 F Supp 361-68 (E. D. Cal 1975).

Descriptors: *California, *Federal Power Act, *Federal-state water rights conflicts, *Administrative agencies, Legal aspects, Jurisdiction, State jurisdiction, Water rights, Irrigation districts, Projects, Judicial decisions, Canals, Tunnels, Federal government, State governments, Relative rights, Reservoirs.
Identifiers: Injunctions(Prohibitory), Federal Power Commission, California Public Utilities Commission.

Plaintiff state brought action seeking declaratory and injunctive relief regarding alleged conflicting orders between state and federal agencies against defendant irrigation district, itself a state agency. Defendant was required by the Federal Power Commission to construct a tunnel that would be destroyed by plaintiff's project. The state utility commission therefore ordered the plaintiff to be responsible for a substitute facility. Defendant contended that the licensed operation of plaintiff's reservoir would destroy defendant's canal. The plaintiff then contended that damages would result from defendant's unauthorized canal modifications in violation of defendant's obligations under the Federal Power Act, therefore relieving plaintiff of responsibility. The California district court held that while the Federal Power Act confers broad federal control over power projects, states may continue to exercise powers compatible with the duality inherent in the act. States may not veto projects which have been approved by federal agencies. Since the state agency did not substantially interfere with either project, the Federal Power Commission's requirement that the defendant irrigation district build a canal and the state agency's requirement that the plaintiff be financially responsible for the replacement tunnel were not in conflict. (Rieck-Florida)
W77-09582

STATE V LANG (DEFINING TIDAL WETLAND PROPERTY).

383 NYS2d 400-01 (App Div 1976).

Descriptors: *New York, *Wetlands, *Tidal waters, *State jurisdiction, *Regulation, State governments, Marshes, Tidal marshes, Conservation, Land use, Legal aspects, Land management,

Land resources, Protection, Land development, Environmental control, Environmental effects, Land classification.
Identifiers: *Injunctions(Prohibitory).

Plaintiff state brought this action to enjoin defendant land owner from altering the state of tidal wetlands. The defendant was the owner of a one-acre parcel of land which was completely surrounded by partially improved non-wetland property. The one-acre parcel was artificially connected to tidal waters by a ditch, culvert and pipe. The lower court denied plaintiff's motion for a partial summary judgment and granted defendant's cross motion for summary judgment. Affirming the order as appealed, the New York Supreme Court, Appellate Division, held that the one-acre plot, which was only artificially connected to tidal waters and surrounded by partially improved non-wetland property, was not a tidal wetland as defined in the Environmental Conservation Law. (Welch-Florida)
W77-09583

CONSERVATION DISTRICTS LAW.

Wash Rev Code Ann, secs 89.08.005 thru .020, .070 thru .100 and .220 (1975).

Descriptors: *Erosion control, *Long-term planning, *Administrative agencies, *Washington, *Conservation, Legal aspects, State governments, Natural resources, Planning, Water resources development, Water supply, Water utilization, Water distribution(Applied), Erosion.

The Washington legislature has determined that improper land-use practices have contributed to erosion, which in turn has caused the clogging of stream channels and depletion of underground water reserves. Therefore, the legislature has provided for the creation of conservation districts that will preserve the land resources of the state and will also work to control flooding and soil erosion. These districts shall have the following powers: (1) to conduct surveys and research relating to resource conservation; (2) to conduct educational projects; (3) to carry out preventative and control measures and works of improvement for the conservation of renewable natural resources; (4) to prepare and keep current a comprehensive long-range program recommending conservation of all renewable resources, including watershed stabilization, water for agriculture, and the prevention of pollution and sedimentation; (5) to sue and be sued; and (6) to enter into joint projects with other districts. (Frank-Florida)
W77-09584

FLOOD CONTROL.

Utah Code Ann sec 65-1-75 (1968).

Descriptors: *Utah, *Flood control, *Flood protection, *Administrative agencies, Legislation, Water control, Flood damage, Flood forecasting, Floods, Non-structural alternatives, Water distribution(Applied), Water management(Applied), Water policy, Flood data, Flood flow, Flooding, Engineering structures, Equipment, Control structures, Diversion structures, Administrative costs, Project planning, Social aspects, Personnel management.
Identifiers: *State land board(Utah).

The Utah state land board may survey any lands of the state, and all areas where there have been damaging floods, or where such floods are likely to occur, in order to prevent and control floods, and to conserve the natural resources of the state. Cooperation with the people of the affected communities, counties, cities or towns, state road commission, federal government and such other interested persons is suggested. The state land board may construct flood-control works, acquire additional lands for flood prevention and control, employ the services of qualified engineers, foresters and rangers, and may study and

recommend solutions to flood-control problems. In addition, the board may promote revegetation and range improvement of any state lands, control grazing on any state lands, acquire in cooperation with the federal government watershed lands which have become barren and capable of causing floods, and expend funds to pay the costs of such activities. (Hadoulas-Florida)
W77-09585

DOBBS V MISSOURI PACIFIC RAILROAD COMPANY (LIABILITY OF RAILROADS FOR SURFACE WATER DIVERSION).

416 F Supp 5-9 (E D Okla 1975).

Descriptors: *Railroads, *Surface waters, *Oklahoma, *Trespass, *Diversion losses, Diversion, Legal aspects, Judicial decisions, Legal review, Water law, Common law, Legislation, Negligence, Governments, State governments, Risks.
Identifiers: *Missouri Pacific Railroad Company, *Federal civil procedure, Common enemy rule.

Plaintiff owns property adjacent to the tracks of defendant, the Missouri Pacific Railroad Company. Improvements made by the railroad caused surface water to divert from its natural course. Plaintiff seeks recovery for damages allegedly resulting from the diversion. The District Court denied defendant's motion to dismiss the complaint for failure to state a cause of action, stating two legal theories upon which plaintiff could rely. First, as to defendant's contention that the statute of limitations had run since the railroad made the improvements over twenty years ago, the court ruled that a cause of action arose when the trespass actually occurs. The plaintiff need only prove that the improvement is permanent in nature, and that the trespass is not the natural result or obvious consequence of the permanent improvement, regardless of when the improvements were actually made. The court also ruled that plaintiff could maintain an action based on the wrongful diversion of surface water. In Oklahoma one has a right to divert surface water, but only to the extent that it does not harm neighboring land. If damage does result from such diversion of surface water, the party causing such damage is liable for it. (Moorhouse-Florida)
W77-09586

AN OPTIMAL STATE WATER LAW: FIXED WATER RIGHTS AND FLEXIBLE MARKET PRICES.

D. D. Johnson.
Virginia Law Review, Vol 57, p 345-74 (1971).

Descriptors: *Environmental effects, *Cost allocation, *Water allocation(Policy), *Appropriation, *Economic efficiency, Recirculated water, Recycling, Economic impact, Econometrics, Recharge, Cost sharing, Cost analysis, Economic justification, Costs, Cost repayment.

Under present water appropriation systems, there is not enough water to fill all needs. Recent legislation has focused on water quality and pollution control to solve the problem resulting from the growing divergence between the demand for and supply of water. But, this narrow approach does not consider the quantity of water demanded, the supply available, or a system for distribution. This article proposes to: establish economic criteria for measuring social benefits; consider characteristics of alternative processes; discuss inadequacies inherent in existing water allocation systems; and present a general plan for water allocation that considers supply and demand, provides a mechanism for allocation, and solves the problem of pollution control and abatement. The proposed system allocates water supplies for a price. The price reflects costs involved in furnishing water to the public and private users. Different qualities of water would demand different prices. A schedule of total demands by competing users would be

determined. Thereafter, a set of prices would be fixed at which demands for all users would be satisfied. This comprehensive approach guarantees that water will be allocated to uses getting the highest marginal benefit from water. (Joseph-Florida)
W77-09587

6F. Nonstructural Alternatives

INSTITUTIONAL CONSTRAINTS ON WATER RESOURCE DEVELOPMENT IN ARID LANDS.
For primary bibliographic entry see Field 6E.
W77-09316

FLOOD PLAIN INFORMATION: RIO SAN JOSE, PUEBLO OF ACOMA, NEW MEXICO.
Army Engineer District, Albuquerque, N.M.
For primary bibliographic entry see Field 4A.
W77-09363

FLOOD PLAIN INFORMATION: BIG AND LITTLE FOSSIL CREEKS, FORT WORTH, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-09364

FLOOD PLAIN INFORMATION: WARD CREEK AND TRIBUTARIES, BATON ROUGE, LOUISIANA, NO. 2.
Army Engineer District, New Orleans, La.
For primary bibliographic entry see Field 4A.
W77-09365

FLOOD PLAIN INFORMATION: VERMILION RIVER AND TRIBUTARIES, LAFAYETTE, LOUISIANA.
Army Engineer District, New Orleans, La.
For primary bibliographic entry see Field 4A.
W77-09366

FLOOD PLAIN INFORMATION, LITTLE RIVER, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, Va.
For primary bibliographic entry see Field 4A.
W77-09367

FLOOD PLAIN INFORMATION, STONY RUN CREEK, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, Va.
For primary bibliographic entry see Field 4A.
W77-09368

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER AND LILLIBRIDGE CREEK, BOROUGH OF PORT ALLEGANY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, Pa.
For primary bibliographic entry see Field 4A.
W77-09369

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, FOREST COUNTY, PENNSYLVANIA.
Army Engineer District, Pittsburgh, Pa.
For primary bibliographic entry see Field 4A.
W77-09370

WEST FORK DES MOINES RIVER AND PERKINS CREEK FLOOD PLAIN INFORMATION, WINDOM, MINNESOTA.
Army Engineer District, Rock Island, Ill.
For primary bibliographic entry see Field 4A.
W77-09371

FLOOD PLAIN INFORMATION: LITTLE DRY-FORK, LOVE BRANCH, BURGER BRANCH, CITY OF ROLLA, MISSOURI.
Army Engineer District, St. Louis, Mo.
For primary bibliographic entry see Field 4A.
W77-09372

FLOOD PLAIN INFORMATION: ST. CHARLES COUNTY, MISSOURI, PART 3, CUIVRE RIVER AND TRIBUTARIES.
Army Engineer District, St. Louis, Mo.
For primary bibliographic entry see Field 4A.
W77-09373

FLOOD PLAIN INFORMATION: STE. GENEVIEVE, MISSOURI: MISSISSIPPI RIVER, NORTH AND SOUTH GABOURI CREEKS.
Army Engineer District, St. Louis, Mo.
For primary bibliographic entry see Field 4A.
W77-09374

FLOOD PLAIN INFORMATION, ADAMS CREEK AND TRIBUTARIES, TULSA AND WAGONER COUNTIES, OK.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W77-09375

FLOOD PLAIN INFORMATION: HOLLIDAY AND MCGRATH CREEKS, WICHITA FALLS, TEXAS.
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W77-09376

BINGHAMTON WASTEWATER MANAGEMENT STUDY: SPECIALTY APPENDIX.
Army Engineer District, Baltimore, Md.
For primary bibliographic entry see Field 5G.
W77-09384

FLOODPLAIN ZONING—AN ALTERNATIVE APPROACH TO LAND REGULATION IN FLOOD HAZARD AREAS: A CASE STUDY, KALAMAZOO, MICHIGAN.
S. D. Mac Rae.
Shore and Beach, Vol 44, p 31-34 (April 1976). 2 fig, 1 tab.

Descriptors: *Flood plain zoning, *Michigan, *Floodways, *Flood control, *Land use, Legal aspects, Regulation, Water zoning, Zoning, Beneficial use, Flood plains, Flood protection, Non-structural alternatives, Water resources development, Flood discharge, Flood profiles, Regulation, Environmental effects, Land development, Land management, Land classification, Flood frequency.
Identifiers: *Kalamazoo(Mich).

The author examines the use of flood plain zoning in Kalamazoo, Michigan as a method of land use regulation for controlling hazardous flood conditions. A floodplain is that area of land adjoining a watercourse which has been or may be covered by floodwater. A floodway is a high flood area, and a flood fringe is that portion of the floodplain beyond the limits of the floodway. The historical evidence of flooding, the expected frequency of floods, and engineering studies of flood levels are among the factors considered when delineating the boundaries of the floodplain. Floodplain regulations via zoning, have so far proved to be legally permissible. Such authority and power to zone is grounded in the state police powers which permit land use regulations to protect the health, safety, morals or welfare of the public. Floodplain regulations create open spaces by prohibiting construction in the floodway area. Buildings are allowed however, in flood fringe areas provided they are elevated above a designated regulatory flood level. (Hadoulas-Florida)
W77-09532

LAND USE CONTROL IN THE COASTAL ZONE: THE DELAWARE EXAMPLE.
Natural Resources Law Inst. Portland, Oreg.
J. L. Pedrick, Jr.
Coastal Zone Management Journal, Vol 2, No 4, p 345-368 (1976).

Descriptors: *Land use, *Land management, *Constitutional law, *Delaware, Government interrelations, Inter-agency cooperation, Water resources development, Water policy, Coastal areas, Beaches, Wetlands, Land reclamation, Industries, Permits, Dredging, Drainage, Landfills, Preservation, Conservation, Compensation, Legislation, Programs, Planning, Administrative agencies, Projects, Environmental effects.
Identifiers: *Coastal Zone Management Program, Coastal waters, *Coastal zone management.

This article focuses on the administrative, legal and intergovernmental controversies arising under Delaware's Coastal Zone Management Act. The effects of the Act on Sussex County are specifically discussed. The three areas of land use regulation critically analyzed include industry regulation in the coastal zone, beach preservation, and wetland preservation. Delaware's Coastal Zone Act completely prohibits new heavy industry in the coastal zone, and requires permits for expansions or extensions of pre-existing industry. Permits must also be obtained prior to making substantial changes in the character of beach property. Permits are required for dredging, draining, filling, and other like activities in wetland areas. Courts have permitted land use regulations because the public interests favoring preservation of such areas outweigh the injured private rights. However, such regulations are becoming subject to attack under the 5th and 14th Amendments of the U.S. Constitution on allegations of taking private property without just compensation in violation of due process. The author suggests that the administrative coordination of the Act be improved, and that the decision making chain of command allow for decision making on local levels. The author thinks Delaware's Act is constitutional. (Hadoulas-Florida)
W77-09533

NEW ROLES FOR THE OLD DAM BUILDERS.
National Wildlife Federation, Washington, D. C.
General Counsel Office.
O. A. Houck.
National Wildlife, Vol 13, No 5, p 13-15 (1975).

Descriptors: *Environmental effects, *Wetlands, *Political aspects, *Environmental engineering, Environmental control, Regulation, Governmental interrelations, Federal government, Navigable waters, Non-structural alternatives, Dams, Environment, Water policy, Water management(Applied), Flood control, Legislation, Judicial decisions.
Identifiers: *National Environmental Policy Act, Private interest groups.

Environmentalists are greatly concerned with the issue of whether the Army Corps of Engineers has significantly changed its approach towards environmental regulation. Historically, the Corps has favored political and economic interests to the detriment of environmental interests in its sponsorship of projects. It has functioned as an engineering firm, shirking its duties as an environmental regulator. By 1975 objections to Corps' projects became widespread. Environmental groups, using the National Environmental Policy Act (NEPA) as their handle, began to use the courts to voice their objections. Recently, moreover, the winds of change have come into the Corps' system. There are indications that it has changed its approach to flood control and environmental protection. How much it has changed is not clear, however. For example, the Corps is not only a construction agency, but it is also a permitting agency for private construction. In the past the Corps has been slow to exercise this regulatory

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responsibility. As a result of a series of court decisions, the Corps has been thrust squarely into the environmental protection business. The question remains whether the Corps will meet the challenge of regulating, especially with regard to wetlands development, or whether it will fight its responsibilities. (Joseph-Florida)
W77-09552

6G. Ecologic Impact Of Water Development

CHANGES IN THE HABITAT CONDITIONS OF ANIMALS IN THE VOLGA DELTA ASSOCIATED WITH THE IMPLEMENTATION OF THE VOLGOGRAD HYDROELECTRIC STATION, (IN RUSSIAN), V. V. Vinogradov, and S. I. Chernyavskaya. Byull Mosk O-Va Ispyt Prir Otd Biol 81(1), p 136-138, 1976.

Descriptors: *Wildlife habitats, *Deltas, *Dams, *Succession, *Environmental effects, Hydroelectric plants, Hydrologic budget, Alluvial channels, Willow trees, Flow.
Identifiers: Osiers, *USSR(Volga River), Volgograd, Vegetation changes.

Since implementation of the Volgograd dam (USSR) in 1958, significant changes have occurred in the hydrological regime and ecological conditions of the Volga delta. Vastly reduced alluvial deposits slowed the formation of new islands and spits, thereby hampering the renewal of osier beds. As the sprouting ability of the white willow declines after 20 yr, the highly productive water-retaining and soil-preserving willow association is replaced by a less productive reed-grass association. Animal species affected by these conditions and other changes in water flow are listed and the dynamics of particular ecological disruptions are discussed.—Copyright 1977, Biological Abstracts, Inc.
W77-09102

THE ENVIRONMENTAL IMPULSE AND ITS COMPETITORS: ATTITUDES, INTERESTS, AND INSTITUTIONS AT LAKE TAHOE, California Univ., Davis. Dept. of Political Science. For primary bibliographic entry see Field 6B.
W77-09145

ENVIRONMENTAL MODELING AND SIMULATION, PROCEEDINGS OF THE CONFERENCE ON, Environmental Protection Agency, Washington, D. C. Office of Research and Development. For primary bibliographic entry see Field 5B.
W77-09154

MODELING THE EFFECT OF PESTICIDE LOADING ON RIVERINE ECOSYSTEMS, Southeast Environmental Research Lab., Athens, Ga. For primary bibliographic entry see Field 5B.
W77-09174

AN ENVIRONMENTAL RESIDUAL ALLOCATION MODEL, Energy Resources Co. Inc., Cambridge, Mass. For primary bibliographic entry see Field 5B.
W77-09179

COMPUTER SIMULATION OF LONG-TERM SECONDARY IMPACTS OF WATER AND WASTEWATER PROJECTS, Boyle Engineering Corp., Newport Beach, Calif. Environmental Studies. For primary bibliographic entry see Field 5B.
W77-09195

THE ENVIRONMENTAL QUALITY MONITORING REPORT, National Oceanic and Atmospheric Administration, Washington, D.C. Outer Continental Shelf Task Force. For primary bibliographic entry see Field 5G.
W77-09231

TRACE METALS IN MANGROVE SEEDLINGS FROM POLLUTED AND UNPOLLUTED BAYS IN PUERTO RICO, Puerto Rico Nuclear Center, Mayaguez. Marine Ecology Div. For primary bibliographic entry see Field 5A.
W77-09240

NOAA SHIP DELAWARE II CRUISE 74-2 REPORT OF MAY 13-21, 1974, SURVEY OF DEEP-WATER DUMPSITE 106, National Marine Fisheries Service, Highlands, N.J. Middle Atlantic Coastal Fisheries Center. For primary bibliographic entry see Field 5B.
W77-09245

INVESTIGATION OF RADIOACTIVE WASTE DISPOSAL AT DEEPWATER DUMPSITE 106—SAMPLING PROGRAM MAY 1974, Office of Radiation Programs, Washington, D.C. For primary bibliographic entry see Field 5B.
W77-09246

LIFE AT THE DESERT'S EDGE, For primary bibliographic entry see Field 4C.
W77-09305

URBAN PLANNING TO MINIMIZE ENVIRONMENTAL IMPACT, Illinois Univ. at Chicago Circle. Dept. of Systems Engineering. For primary bibliographic entry see Field 6B.
W77-09377

ANTI-POLLUTION BEHAVIOR: A FUNCTION OF PERCEIVED OUTCOME AND LOCUS OF CONTROL, L. J. Trigg, D. Perlman, R. P. Perry, and M. P. Janisse. Environment and Behavior, Vol 8, No 2, p 307-313, June 1976. 1 tab, 12 ref.

Descriptors: *Psychological aspects, Behavior, *Motivation, *Attitudes, Correlation analysis, Surveys.
Identifiers: Perceived outcome, Locus of control.

The study postulates two hypotheses. Hypothesis 1: Internally oriented individuals have more accurate information about environmental pollution. Internally oriented individuals are defined as those believing that their rewards are contingent upon their own abilities, effort, and skill; external individuals believe their rewards are contingent upon luck, chance, or 'powerful others'. Hypothesis 2: Among people optimistic about future levels of pollution, internals would engage in more anti-pollution activities than externals. Data collected in a survey on environmental issues were used to test these hypotheses. Multistage probability and clustering sampling techniques were used to draw the sample of potential respondents. Two analyses of variance were used to assess the survey responses. Knowledge and anti-pollution behavior were the dependent variables. Locus of control, perceived outcome of pollution, and sex were the independent variables. The data supported the hypothesis that internals have more accurate information about environmental pollution. They also demonstrated that when people had favorable expectations about future levels of pollution, internal locus of control was associated with greater involvement in conventional forms of social action. (Nessa-NC)
W77-09378

BINGHAMTON WASTEWATER MANAGEMENT STUDY: IMPACT ASSESSMENT AND EVALUATION APPENDIX, Army Engineer District, Baltimore, Md. For primary bibliographic entry see Field 5G.
W77-09386

RESTORING THE WILLAMETTE RIVER: COSTS AND IMPACTS OF WATER QUALITY CONTROL, Oregon State Univ., Corvallis. For primary bibliographic entry see Field 5G.
W77-09455

ENVIRONMENTAL POLICY-MAKING IN THE USSR: THE ROLE OF INDUSTRIAL AND ENVIRONMENTAL INTEREST GROUPS, Mississippi State Univ., State College. For primary bibliographic entry see Field 6E.
W77-09456

SITING OF MAJOR ENERGY FACILITIES, Organization for Economic Co-Operation and Development, Paris (France). Environmental Directorate 32098, 1977. 87 p, 6 fig, 7 tab, 106 ref, 3 append.

Descriptors: *Sites, *Powerplants, *Facilities, *Environmental effects, Locating, Permits, Nuclear powerplants, Electric power production, Water demand, Decision making, Social aspects, Political aspects, Cost-benefit analysis.

To provide member governments of the Organization for Economic Cooperation and Development with policy options or guidelines to prevent or minimize environmental conflicts, problems involved in selection of sites for energy-generating facilities are enumerated and reviewed. The report aims at forecasting demands for sites and examines criteria against which a choice can be made for any given site. After estimating the number of sites required in the OECD countries, based on predicted electrical demands and fuel supplies, methods of identifying suitable sites are described. Official procedures for licensing power generating plants are given for the United Kingdom, Federal German Republic, Sweden, France and the United States; for the latter, licensing and permit procedures are enumerated for both the federal and state level. Environmental impact assessment procedures are also given for such plants for the United States, Spain and Canada. Also provided is a checklist of criteria used in siting decisions, taking into account electrical energy needs and impacts on land use, water resources, air quality, solid waste disposal, radiation, and noise. Other materials deal with considerations of public response and participation and interactions between the technical and environmental factors in plant siting. (Harris-Wisconsin)
W77-09459

ENVIRONMENTAL IMPACTS FROM OFFSHORE EXPLORATION AND PRODUCTION OF OIL AND GAS, Organization for Economic Co-Operation and Development, Paris (France). Environment Directorate 32090, 1977. 95 p, 24 fig, 22 tab, 24 ref.

Descriptors: *Continental slope, *Oil pollution, *Oil industry, *International waters, *Natural gas, *Environmental effects, Oil spills, Offshore platforms, Engineering structures, Coastal structures, Drilling, Exploration, Water pollution sources, Water pollution effects, International commissions, International law, Social aspects, Harbors, Oceans, Continental shelf.
Identifiers: *Offshore oil production.

To provide member nations of the Organization for Economic Cooperation and Development with policy options or guidelines to prevent or minimize

RESOURCES DATA—Field 7

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environmental conflicts, information is given on issues raised by the offshore oil and gas development and solutions are suggested. Environmental impacts of the industry are described, including trends for OECD countries in terms of likely petroleum reserves and potential pollution effects along shorelines and in the oceans. Five subject areas are covered in greater detail: (1) large accidental spills from offshore platforms and pipelines; (2) chronic pollution from offshore activities; (3) legislation concerning the structural integrity of offshore structures; (4) probability of occurrence of oil spills; and (5) onshore effects from offshore activity. Additionally, guidelines are presented for siting large installations, including concrete platform construction units, deepwater harbors, pipelines terminals, harbor supply bases, administrative headquarters and oil-related manufacturing. Also described are social effects leading to adverse environmental effects, such as the influx of large work forces with oil industry developments. (Harris-Wisconsin)

W77-09460

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM (FINAL ENVIRONMENTAL STATEMENT).

Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 5G.

W77-09527

REPORT TO CONGRESS ON ABNORMAL OCCURRENCES: JULY-SEPTEMBER 1975.

Nuclear Regulatory Commission, Washington, D.C.
For primary bibliographic entry see Field 6E.

W77-09549

THE NEED FOR A NATIONAL OCEAN PROGRAM AND PLAN.

For primary bibliographic entry see Field 6E.

W77-09555

HILL V TENNESSEE VALLEY AUTHORITY (APPLICATION OF ENDANGERED SPECIES ACT TO FEDERAL PROJECT).

For primary bibliographic entry see Field 6E.

W77-09581

7. RESOURCES DATA

7A. Network Design

DEVELOPMENT OF THE SPRING CREEK DATA ACQUISITION SYSTEM.

Montana State Univ., Bozeman. Dept. of Electrical Engineering.
R. M. Williams.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 499. Price codes: A04 in paper copy, A01 in microfiche. Research Report No. 3174, Electronics Research Laboratory, Montana State University, Bozeman, August 1974. 51 p., 9 fig., 3 tab., 9 fig., append. OWR-068-MONT(1).

Descriptors: *Data acquisition, *Instrumentation, *Data transmission, *Telemetry, Data processing, Computers, Electronic equipment, Monitoring, Streamflow, *Montana.
Identifiers: *Teletype, *Stream monitoring, Acoustic couplers, *Spring Creek(Mont).

Development of a computer-operated remote data acquisition system located on Spring Creek, Bozeman, Montana is described. The experimental Spring Creek station is the location of various weather and stream monitoring instruments all interfaced to the data acquisition system for remote interrogation by an HP 2115-A computer. A user may also call the computer from his location and

obtain reports by using an acoustic coupler and teletype. Presented are a physical description of the Spring Creek Station and data communication link; a hardware description including instruments, interfaces, and modifications; a description of the software development; and, a few remarks on the present and future use of the system. (Holje-Mont St)

W77-09258

COASTAL ENGINEERING DATA NETWORK. SECOND SEMI-ANNUAL REPORT JULY 1976 TO DECEMBER 1976.

California Univ., San Diego, La Jolla. Inst. of Marine Resources.
For primary bibliographic entry see Field 8B.

W77-09329

7B. Data Acquisition

HYDROGRAPHIC SURVEYING TURNS TO ELECTRONICS.

Tibbets Abbott, McCarthy and Stratton, Seattle, Wash.
R. A. Heinz.
Civil Engineering-American Society of Civil Engineers, Vol. 47, No. 4, p 62-65, April 1977. 1 fig., 1 tab.

Descriptors: *Hydrography, *Remote sensing, *Surveys, Bathymetry, Water levels, Depth, Equipment, Boats, Electronic equipment, Underwater, Sounding, Sonar, Sound waves, Microwaves, Radar, Satellites(Artificial), Aerial photography, Surface waters, Coasts, Lakes, Measurement.

The traditional technique for measuring water depth is to use a lead-weighted line. The 'tag line,' stretched along the water surface so that soundings are made in orderly fashion, can be dangerous. Such techniques are being replaced. Now, electronic devices can be used to make both the horizontal measurements (in air) and the vertical (through water). To improve stability of the boat in which the surveying crew operates, multi-hull boats and air-cushion craft are being used or considered. Types of horizontal positioning hardware-including microwave and radar- were described, as were types of water depth measuring gear (among them acoustical, aerial photography, satellite imagery, side-scan sonar, and sub-bottom profiling). (Sims-ISWS)

W77-09105

RECORDING RIVER AND RESERVOIR WATER DEPTH.

Moore, Gardner and Associates, Inc., Asheboro, N. C.
M. Gilmore.
Civil Engineering-American Society of Civil Engineers, Vol. 47, No. 4, p 65-66, April 1977. 1 fig.

Descriptors: *Hydrography, *Remote sensing, *Surveys, Bathymetry, Depth, Equipment, Electronic equipment, Sonar, Sounding, Rivers, Reservoirs, Measurement, Data processing, Sediments, Reservoir silting, Sedimentation.
Identifiers: *Kerr Reservoir, *Roanoke River.

At the Kerr Reservoir on the Roanoke River in Virginia and North Carolina, reservoir bottom was surveyed before reservoir filling, and twice thereafter, to determine rate of siltation. The post-filling surveys, in 1959-60 and in 1976, offer an interesting illustration of the progress being made in hydrographic surveying. In both cases, sound-type (sonar) water depth sensors were used. But improvements were made in the latest resurvey: a narrower-beam signal gave accurate measurements at greater depth of water. Hardware for simultaneously printing location and water depth eliminated inaccuracies in the 1959 resurvey, when a cable was used for location. Computer programs

enabled automatically calculating increase in siltation. (Sims-ISWS)

W77-09106

ICE AND OCEAN TILT MEASUREMENTS IN THE BEAUFORT SEA.

Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
For primary bibliographic entry see Field 2C.

W77-09117

RIDGES ON ANTARCTIC ICE RISES.

British Antarctic Survey, Cambridge (England).
For primary bibliographic entry see Field 2C.

W77-09120

EXTRACTION OF TRACE COMPONENTS FROM LARGE QUANTITIES OF ICE IN BORE HOLES.

Bern Univ. (Switzerland). Physikalisches Institut.
For primary bibliographic entry see Field 2C.

W77-09121

A METHOD OF CONCENTRATING THE MAJOR IMPURITIES CONTAINED IN ICE BY ION EXCHANGE.

Grenoble-1 Univ. (France). Institut de Geographie Alpine.
For primary bibliographic entry see Field 2C.

W77-09122

ON THE USE OF TENSIOMETERS IN SNOW HYDROLOGY.

Cold Regions Research and Engineering Lab., Hanover, N. H.
For primary bibliographic entry see Field 2C.

W77-09123

PORTABLE AUTOMATED MESONET IN OPERATION.

National Center for Atmospheric Research, Boulder, Colo.
For primary bibliographic entry see Field 2B.

W77-09131

PHOTOGRAPHIC RECONNAISSANCE OF CONTINENTAL SLOPE AND UPPER CONTINENTAL RISE.

Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 5B.

W77-09247

PREDICTING SNOW DEPTHS ON A MOUNTAIN WATERSHED.

Colorado State Univ., Fort Collins. Dept. of Fishing and Wildlife Biology.
For primary bibliographic entry see Field 2C.

W77-09257

AN IMPROVED TECHNIQUE FOR MEASURING SOIL PH.

Montana Agricultural Experiment Station, Bozeman.
For primary bibliographic entry see Field 2G.

W77-09295

EVAPORATION AND EVAPOTRANSPIRATION IN NIGERIA.

For primary bibliographic entry see Field 2D.

W77-09299

MEASUREMENT OF WATER FLUXES AND POTENTIALS IN A SINGLE ROOT-SOIL SYSTEM I. THE TENSIOMETER-POTOMETER SYSTEM.

University of New England, Armidale (Australia). Dept. of Agronomy and Soil Science.

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

For primary bibliographic entry see Field 2I.
W77-09308

REMOTE SENSING METHODS AND PROBLEM OF NATURAL RESOURCE INVENTORY, (IN RUSSIAN), Ashkhabad (USSR).
N. G. Kharin.
Probl Osvoeniya Pustyn'. 3, p 3-7, 1974.

Descriptors: *Aerial photography, *Remote sensing, Data processing, *Natural resources, Radar, Spectroscopy, X-ray analysis, *Surveys, Electromagnetic wave.

Modern inventory of natural resources is based in aerial photography. Remote sensing is a valuable aid, using wide band registration of electromagnetic waves and data processing. For this purpose multispectral, thermal and radar systems should be used. Special regional centers for inventoring natural resources should be organized, all the resources of the region being estimated at one time.—Copyright 1975, Biological Abstracts, Inc.
W77-09311

SATELLITE MICROWAVE OBSERVATIONS OF SOIL MOISTURE VARIATIONS, National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 2G.
W77-09335

ON THE FLUCTUATIONS IN LEVELS OF CLOSED LAKES, Commonwealth Scientific and Indu.
For primary bibliographic entry see Field 2H.
W77-09338

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 1, ABSTRACTS, National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 10C.
W77-09344

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 2, INDEXES, National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 10C.
W77-09345

EARTH RESOURCES--A CONTINUING BIBLIOGRAPHY WITH INDEXES, National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 10C.
W77-09346

SCALING FIELD-MEASURED SOIL HYDRAULIC PROPERTIES USING A SIMILAR MEDIA CONCEPT, Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
For primary bibliographic entry see Field 2G.
W77-09350

SATELLITE AND CURRENT DROGUE STUDIES OF OCEAN-DISPOSED WASTE DRIFT, Delaware Univ., Newark. Center for Remote Sensing.
For primary bibliographic entry see Field 5B.
W77-09358

A SIMPLE CONTINUOUS ICE CRYSTAL REPLICATOR FOR USE IN LABORATORY CLOUD CHAMBERS, Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
For primary bibliographic entry see Field 2B.
W77-09360

A SUGGESTED TECHNIQUE FOR THE ANALYSIS OF AIRBORNE CONTINUOUS ICE NUCLEUS DATA, Montana State Univ., Bozeman. Dept. of Earth Sciences.
For primary bibliographic entry see Field 3B.
W77-09361

A METHOD FOR SECTIONING SATURATED SOIL CORES, Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-09436

A PORTABLE RAINFALL SIMULATOR FOR ERODIBILITY AND INFILTRATION MEASUREMENTS ON RUGGED TERRAIN, Klamath National Forest, Yreka, Calif.
For primary bibliographic entry see Field 2J.
W77-09441

IN SITU MEASUREMENT OF GAS DIFFUSION COEFFICIENT IN SOILS, Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 2G.
W77-09442

REMOTE SENSING OF SUBMERGED AQUATIC VEGETATION IN THE LOWER CHEASAPEAKE BAY, Virginia Inst., of Marine Science, Gloucester Point. Div. of Biological Oceanography.
For primary bibliographic entry see Field 2L.
W77-09468

7C. Evaluation, Processing and Publication

GROUNDWATER RESOURCES OF AUSTRALIA, Australian Water Resources Council, Canberra.
For primary bibliographic entry see Field 4B.
W77-09103

CRITERION TO CHOOSE STEP LENGTH FOR SOME NUMERICAL METHODS USED IN HYDROLOGY, New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 2E.
W77-09110

PLEISTOCENE GLACIATION IN ETHIOPIA: NEW EVIDENCE, Oregon State Univ., Corvallis. Dept. of Geology.
For primary bibliographic entry see Field 2C.
W77-09124

A MULTI-PARAMETER ESTUARY MODEL, Tetra Tech., Inc., Lafayette, Calif.
For primary bibliographic entry see Field 5B.
W77-09165

EFFICIENT STORAGE OF URBAN STORM WATER RUNOFF, Environmental Protection Agency, Denver, Colo.
For primary bibliographic entry see Field 5D.

W77-09171

FEDBAK03 - A COMPUTER PROGRAM FOR THE MODELLING OF FIRST ORDER CONSECUTIVE REACTIONS WITH FEEDBACK UNDER A STEADY STATE MULTIDIMENSIONAL NATURAL AQUATIC SYSTEM, Environmental Protection Agency, New York. Data Systems Branch.
For primary bibliographic entry see Field 5B.
W77-09176

A DYNAMIC WATER QUALITY SIMULATION MODEL FOR THE THAMES RIVER, Ontario Ministry of the Environment, Toronto (Ontario). Water Resources Branch.
For primary bibliographic entry see Field 5B.
W77-09182

SELECTING THE PROPER REAERATION COEFFICIENT FOR USE IN WATER QUALITY MODELS, Texas Water Quality Board, Austin. Administrative Operations.
For primary bibliographic entry see Field 5G.
W77-09184

RECEIV-II, A GENERALIZED DYNAMIC PLANNING MODEL FOR WATER QUALITY MANAGEMENT, Raytheon Co., Portsmouth, R.I. Oceanographic and Environmental Services.
For primary bibliographic entry see Field 5B.
W77-09185

MODIFICATIONS TO QUAL - II TO EVALUATE WASTEWATER STORAGE, Environmental Protection Agency, Atlanta, Ga. Technical Support Branch.
For primary bibliographic entry see Field 5D.
W77-09186

WATER POLLUTION MODELING IN THE DETROIT METROPOLITAN AREA, Detroit Water and Sewerage Dept. Mich.; and Wayne State Univ. Detroit, Mich. Coll. of Engineering.
For primary bibliographic entry see Field 5B.
W77-09187

A RIVER BASIN PLANNING METHODOLOGY FOR STREAMS WITH DISSOLVED OXYGEN AND EUTROPHICATION CONSTRAINTS, Army Engineer Waterways Experiment Station, Vicksburg, Miss. Environmental Effects Lab.
For primary bibliographic entry see Field 5B.
W77-09198

SWAN, A SEWER ANALYSIS AND MODELING SYSTEM, Erdman Anthony, Associates. Rochester, N.Y.
For primary bibliographic entry see Field 5D.
W77-09206

ON-LINE MODELS FOR COMPUTERIZED CONTROL OF COMBINED SEWERS, Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-09207

MATHEMATICAL MODELS FOR CALCULATING PERFORMANCE AND COST OF WASTEWATER TREATMENT SYSTEMS, Municipal Environmental Research Lab., Cincinnati, Ohio. Systems and Economic Analysis Section.
For primary bibliographic entry see Field 5D.
W77-09208

DATA COLLECTION FOR WATER QUALITY MODELING IN THE OCCOQUAN WATERSHED OF VIRGINIA, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering. For primary bibliographic entry see Field 5A. W77-09211

RESEARCH PROJECTS IN GLACIOLOGY - 1976. Department of the Environment, Ottawa (Ontario). Water Resources Branch. For primary bibliographic entry see Field 2C. W77-09220

CANADIAN GLACIERS IN THE INTERNATIONAL HYDROLOGICAL DECADE PROGRAM, 1965 - 1974, NO. 1. SENTINEL GLACIER, BRITISH COLUMBIA - SUMMARY OF MEASUREMENTS, Department of the Environment, Ottawa (Ontario). Water Planning and Management Branch. For primary bibliographic entry see Field 2C. W77-09222

USERS MANUAL - OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM. Environmental Protection Agency, Washington, D.C. Div. of Oil and Hazardous Materials. For primary bibliographic entry see Field 5G. W77-09229

PHYSICAL OCEANOGRAPHY HISTORICAL DATA FOR DEEPWATER DUMPSITE 106, National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group. For primary bibliographic entry see Field 5B. W77-09248

PHYSICAL OCEANOGRAPHIC OBSERVATIONS AT DEEPWATER DUMPSITE 106 -- MAY 1974, National Marine Fisheries Service, Narragansett, R.I. Atlantic Environmental Group. For primary bibliographic entry see Field 5B. W77-09249

DEVELOPMENT OF THE SPRING CREEK DATA ACQUISITION SYSTEM, Montana State Univ., Bozeman. Dept. of Electrical Engineering. For primary bibliographic entry see Field 7A. W77-09258

THE ROLE OF SYSTEMS ANALYSIS IN THE USE OF AGRICULTURAL WASTES, Manitoba Univ., Winnipeg. Dept. of Agricultural Engineering. For primary bibliographic entry see Field 5G. W77-09282

REMOTE SENSING METHODS AND PROBLEM OF NATURAL RESOURCE INVENTORY, (IN RUSSIAN), Desert Inst., Ashkhabad (USSR). For primary bibliographic entry see Field 7B. W77-09311

THE CITIZEN'S GUIDE TO NORTH CAROLINA'S SHIFTING INLETS, North Carolina State Univ. at Raleigh. Center for Urban Affairs and Community Services. For primary bibliographic entry see Field 2L. W77-09327

COASTAL ENGINEERING DATA NETWORK. SECOND SEMI-ANNUAL REPORT JULY 1976 TO DECEMBER 1976, California Univ., San Diego, La Jolla. Inst. of Marine Resources. For primary bibliographic entry see Field 8B. W77-09329

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 1, ABSTRACTS. National Aeronautics and Space Administration, Washington, D.C. For primary bibliographic entry see Field 10C. W77-09344

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 2, INDEXES. National Aeronautics and Space Administration, Washington, D.C. For primary bibliographic entry see Field 10C. W77-09345

EARTH RESOURCES--A CONTINUING BIBLIOGRAPHY WITH INDEXES. National Aeronautics and Space Administration, Washington, D.C. For primary bibliographic entry see Field 10C. W77-09346

BAYESIAN GENERATION OF SYNTHETIC STREAMFLOWS, 2. THE MULTIVARIATE CASE, Simon Bolivar Univ., Caracas (Venezuela). For primary bibliographic entry see Field 2E. W77-09349

FLOOD PLAIN INFORMATION: RIO SAN JOSE, PUEBLO OF ACOMA, NEW MEXICO. Army Engineer District, Albuquerque, N.M. For primary bibliographic entry see Field 4A. W77-09363

FLOOD PLAIN INFORMATION: BIG AND LITTLE FOSSIL CREEKS, FORT WORTH, TEXAS. Army Engineer District, Fort Worth, Tex. For primary bibliographic entry see Field 4A. W77-09364

FLOOD PLAIN INFORMATION: WARD CREEK AND TRIBUTARIES, BATON ROUGE, LOUISIANA, NO. 2. Army Engineer District, New Orleans, La. For primary bibliographic entry see Field 4A. W77-09365

FLOOD PLAIN INFORMATION: VERMILION RIVER AND TRIBUTARIES, LAFAYETTE, LOUISIANA. Army Engineer District, New Orleans, La. For primary bibliographic entry see Field 4A. W77-09366

FLOOD PLAIN INFORMATION, LITTLE RIVER, HANOVER COUNTY, VA. Army Engineer District, Norfolk, Va. For primary bibliographic entry see Field 4A. W77-09367

FLOOD PLAIN INFORMATION, STONY RUN CREEK, HANOVER COUNTY, VA. Army Engineer District, Norfolk, Va. For primary bibliographic entry see Field 4A. W77-09368

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER AND LILLIBRIDGE CREEK, BOROUGH OF PORT ALLEGANY, PENNSYLVANIA. Army Engineer District, Pittsburgh, Pa. For primary bibliographic entry see Field 4A. W77-09369

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, FOREST COUNTY, PENNSYLVANIA. Army Engineer District, Pittsburgh, Pa. For primary bibliographic entry see Field 4A. W77-09370

WEST FORK DES MOINES RIVER AND PERKINS CREEK FLOOD PLAIN INFORMATION, WINDOM, MINNESOTA. Army Engineer District, Rock Island, Ill. For primary bibliographic entry see Field 4A. W77-09371

FLOOD PLAIN INFORMATION: LITTLE DRY FORK, LOVE BRANCH, BURGER BRANCH, CITY OF ROLLA, MISSOURI. Army Engineer District, St. Louis, Mo. For primary bibliographic entry see Field 4A. W77-09372

FLOOD PLAIN INFORMATION: ST. CHARLES COUNTY, MISSOURI, PART 3, CUIVRE RIVER AND TRIBUTARIES. Army Engineer District, St. Louis, Mo. For primary bibliographic entry see Field 4A. W77-09373

FLOOD PLAIN INFORMATION: STE. GENEVIEVE, MISSOURI; MISSISSIPPI RIVER, NORTH AND SOUTH GABOURI CREEKS. Army Engineer District, St. Louis, Mo. For primary bibliographic entry see Field 4A. W77-09374

FLOOD PLAIN INFORMATION, ADAMS CREEK AND TRIBUTARIES, TULSA AND WAGONER COUNTIES, OK. Army Engineer District, Tulsa, Okla. For primary bibliographic entry see Field 4A. W77-09375

FLOOD PLAIN INFORMATION: HOLLIDAY AND MCGRATH CREEKS, WICHITA FALLS, TEXAS. Army Engineer District, Tulsa, Okla. For primary bibliographic entry see Field 4A. W77-09376

URBAN PLANNING TO MINIMIZE ENVIRONMENTAL IMPACT, Illinois Univ. at Chicago Circle. Dept. of Systems Engineering. For primary bibliographic entry see Field 6B. W77-09377

SIMULTANEOUS INVESTMENT-ALLOCATION: AN APPLICATION OF GENERALIZED BENDERS DECOMPOSITION TO WATER PLANNING, Texas Univ., at Austin. Center for Cybernetic Studies. For primary bibliographic entry see Field 6A. W77-09466

REMOTE SENSING OF SUBMERGED AQUATIC VEGETATION IN THE LOWER CHESAPEAKE BAY, Virginia Inst. of Marine Science, Gloucester Point. Div. of Biological Oceanography. For primary bibliographic entry see Field 2L. W77-09468

Field 7—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

AQUATIC BASELINE SURVEY OF SELECTED TEST AREAS ON EGLIN AIR FORCE BASE RESERVATION, FLORIDA,
Air Force Armament Lab., Eglin AFB, Fla.
R. C. Crews.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 912. Price codes: A02 in paper copy, A01 in microfiche. Report No. AFATL-TR-76-4, January 1976. 23 p, 5 fig, 2 tab, 3 ref, 1 append.

Descriptors: *Baseline studies, *Fish, *Military reservations, *Florida, Streams, Creeks, Varieties, Darters, Madtoms, Lampreys, Shiners.
Identifiers: Eglin AFB(Fla), Armament testing ground, Endangered species, Okaloosa darter.

Seventeen fish and one lamprey species were collected from 23 streams draining areas used for testing and evaluation of conventional munitions developed by the Eglin Air Force Armament Laboratory, Florida. The sailfin shiner (*Notropis hypolepis* Gunther) was the most abundant species encountered. Also abundant were the mosquitofish (*Gambusia affinis* Baird and Girard), blackbanded darter (*Percina nigrofasciata* Agassiz), speckled madtom (*Noturus leptacanthus* Jordan), and the southern brook lamprey (*Ichthyomyzon gagei* Hubbs and Fautman). The endangered Okaloosa darter (*Etheostoma okaloosae* Fowler) was found at every station except at one turbid sampling point. The Okaloosa darter habitats are described and its competition and hybridization with the brown darter (*Etheostoma edwini*) is discounted on the basis of its ecological preferences in this area. A list of species collected from each station is provided in an appendix. (Auen-Wisconsin)
W77-09499

USER'S MANUAL FOR THE M.I.T. TRANSIENT WATER QUALITY NETWORK MODEL—INCLUDING NITROGEN-CYCLE DYNAMICS FOR RIVERS AND ESTUARIES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-09519

8. ENGINEERING WORKS

8A. Structures

WAVE FORCES ON MODELS OF SUBMERGED OFFSHORE STRUCTURES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-09232

8B. Hydraulics

A SEDIMENT TRANSPORT MODEL FOR STRAIGHT ALLUVIAL CHANNELS,
Technical Univ. of Denmark, Copenhagen. Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2J.
W77-09104

WAVE FORCES ON MODELS OF SUBMERGED OFFSHORE STRUCTURES,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
P. E. Versowsky, and J. B. Herbich.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 059. Price codes: A07 in paper copy, A01 in microfiche. Sea Grant Publication No. TAMU-SG-75-215, August 1975. 134 p, 50 fig, 38 ref, 5 append. Also as C.O.E. Report No. 175. Sea Grant 04-3-158-18.

Descriptors: *Waves(Water), *Water pollution control, *Offshore platforms, Ocean waves, Structural analysis, Engineering structures, *Model studies, Hydraulic models, Gravity waves.
Identifiers: *Outer Continental Shelf, *Submerged offshore structures.

The results of a model study of the forces caused by oscillatory waves on large rectangular tank-like submerged objects are presented. Three phases of the problem were examined: (1) description of the forces in terms of dimensionless parameters, (2) description of the effect of large wave heights which are of importance to the designer, and (3) the presentation of a format to be used in model studies on submerged structures. Theoretical studies of the problem have assumed wave heights to be small and the forces to be entirely inertial. However, of interest to the engineer are the forces caused by the larger waves generated by severe storms. In the model study the forces caused by the larger waves were determined and the effect of the water particle velocity in producing a drag force was examined. The relationships between the fluid particle displacement and the coefficient of mass and drag were evaluated. Previous studies indicated that particle displacement is related to the values of empirical coefficients assumed by previous investigation. The experimental results are given in a dimensionless form. Provided the laws of modeling are followed, and there are no scale effects, these results may be used to determine the forces on prototype structures in the ocean. (Sinha-OEIS)
W77-09232

PERFORMANCE ANALYSIS OF A TETHERED FLOAT BREAKWATER,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
R. J. Seymour, and D. M. Hanes.
Sea Grant Publication No. 55; IMR Reference No. 77-102, January 1977. 158 p, 13 fig, 8 ref SG-04-158-20.

Descriptors: *Breakwaters, *Shore protection, Ocean waves, Fetch, Coastal structures, Performance, Model studies.
Identifiers: Wave attenuation, *Tethered floats.

The reports describes laboratory experiments at one-half scale using simulated random seas and field tests at full scale of an installation of a dynamic floating breakwater system in a limited fetch situation. An analytical model is described which successfully predicts the performance of any tethered float breakwater configuration, given the incident wave spectrum. The methodology for selecting the arbitrary resistance coefficients in the predictive model is discussed. Predicted and measured performance data for a total of 60 laboratory and field experiments are displayed, covering a very broad range of wave climates. (NOAA)
W77-09328

COASTAL ENGINEERING DATA NETWORK. SECOND SEMI-ANNUAL REPORT JULY 1976 TO DECEMBER 1976,
California Univ., San Diego, La Jolla. Inst. of Marine Resources.
R. J. Seymour, M. H. Sessions, S. L. Wald, and A. E. Woods.
Sea Grant Publication No. 56; IMR Reference No. 77-103, January 1977. 150 p, 5 fig, 2 ref, append. SG-04-6-153-44110.

Descriptors: *California, *Waves(Water), *Ocean waves, Statistics, Computer programs, Data processing, Coasts, Water resources, *Coastal engineering.
Identifiers: *Physical oceanography, *Wave climate.

The Coastal Engineering Data Network is a cooperative program sponsored by the University

of California Sea Grant College Program and the California Department of Navigation and Ocean Development. The network is devoted primarily to the collection of long-term wave statistics from a large number of nearshore locations, although the capability to collect other nearshore data exists. A fifth station installed by the Coastal Engineering Research Center at Port Hueneme measures sediment transport at the Channel Islands Breakwater north of Port Hueneme. A special interface was constructed so that the output of the wave gage would be compatible with the rest of the system. The system has now been in operation for slightly more than a year. During this period approximately 3,000 data runs or 3 million points were collected with an overall success rate of 95%. The availability of a year's data from a site now allows for some meaningful analysis of the wave climate. The appendix contains the monthly reports for July 1976 through Dec 1976. (NOAA)
W77-09329

A SCREENING MODEL FOR FLOOD CONTROL PLANNING,
California Univ., Los Angeles.
For primary bibliographic entry see Field 4A.
W77-09595

8C. Hydraulic Machinery

THE CALIBRATION OF SHARP CRESTED WEIRS BY THE PONDAGE DRAWDOWN METHOD,
Sheffield Univ. (England). Dept. of Civil and Structural Engineering.
F. A. Johnson, and C. S. Green.
Journal of Hydrology, Vol 33, No 3/4, p 363-373, 1977. 5 fig, 1 tab, 10 ref.

Descriptors: *Weirs, *Calibrations, *Flow measurement, *Drawdown, Ponds, Streamflow, Structures, Hydraulic structures, Flowmeters, Gates, Laboratory tests, Hydrology, Hydraulics.
Identifiers: *Sharp crested weirs, *Pondage drawdown method.

The problems of calibrating flow measuring structures by conventional techniques are outlined. The principle of the pondage drawdown method of calibration was described, and the accuracy of the method was determined by application to a 90 deg V notch sharp crested weir. (Sims-ISWS)
W77-09113

8G. Materials

INVESTIGATION OF THE APAC WATER SEEPAGE BARRIER,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 3B.
W77-09140

8I. Fisheries Engineering

DETERMINATION OF PHYSICAL AND HYDRAULIC PREFERENCES OF BROWN AND BROOK TROUT IN THE SELECTION OF SPAWNING LOCATIONS,
Wyoming Univ., Laramie. Water Resources Research Inst.
For primary bibliographic entry see Field 2I.
W77-09153

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

USERS MANUAL - OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM.

Environmental Protection Agency, Washington, D.C. Div. of Oil and Hazardous Materials.
For primary bibliographic entry see Field 5G.
W77-09229

10C. Secondary Publication And Distribution

COASTAL ZONE MANAGEMENT FOCUS ON NEW ENGLAND; AN ANNOTATED SELECTED BIBLIOGRAPHY.

Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 6B.
W77-09241

WAMIS ABSTRACTS, NO 2,

Arizona Univ., Tucson. School of Renewable Natural Resources.

L. M. White, D. B. Thorud, and P. F. Ffolliott.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 315.
Price codes: A08 in paper copy, A01 in microfiche.
School of Renewable Natural Resources, June 1975. 144 p. OWRT A-042-ARIZ(8). 14-31-0001-5003.

Descriptors: *Information retrieval, *Bibliographies, Wildlife habitats, Burning, Vegetation, *Arizona, *New Mexico, Water quality, Surface waters, Soil erosion, *Rocky Mountain Region.

This bibliography shows a sampling of the references which are retrievable in the Watershed Management Information System (WAMIS), a computerized bibliographic reference retrieval system operated by the School of Renewable Natural Resources, University of Arizona. The three topics used for the computer searches were: wildlife habitats in wooded or shrub areas; burning effects on vegetation in Arizona or New Mexico; and quality of surface water in the Rocky Mountain region (mostly soil erosion material). The total bibliography has some 270 references. (See also W75-05767)
W77-09256

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 1.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09259

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 2.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09260

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 3.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09261

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 4.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09262

HEAVY METALS IN WATER (EXCLUDING MERCURY), A BIBLIOGRAPHY, VOLUME 5.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5A.
W77-09263

URBAN WATER PLANNING, A BIBLIOGRAPHY, VOLUME 2.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-09264

LAND APPLICATION OF WASTE WATER, A BIBLIOGRAPHY.

Office of Water Research and Technology, Washington, D.C.
For primary bibliographic entry see Field 5D.
W77-09265

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 1, ABSTRACTS.

National Aeronautics and Space Administration, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as N-75-25235.
Price codes: A99 in paper copy, A01 in microfiche.
NASA SP-7036(01) February 1975. 654 p.

Descriptors: *Great Lakes, *Information retrieval, *Indexing, *Bibliographies, *Remote sensing, *Abstracts, Agriculture, Forestry, Geology, Mapping, Instrumentation, Aircraft, Geophysics, Water management(Applied), Data processing, Information exchange, Aerial photography, Satellites(Artificial), Natural resources, Hydrology, Minerals, Environment, Oceanography, Ice, Glaciers, River basins, Estuaries, Estuarine environment, Cities.
Identifiers: Earth resources program, Spacecraft, Mineral resources.

The bibliography listed 4930 reports, articles, and other documents introduced into the NASA scientific and technical information system between March 1970 and December 1973. Subject matter was grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, oceanography and marine resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. The publication was issued in two sections: Section 1, Abstracts; and Section 2, Indexes. Each entry in the Abstract section contains a citation and an abstract. The Index section contains five indexes—subject, author, source, contract, and report number. (See also W77-09345) (Froehlich-ISWS)
W77-09344

REMOTE SENSING OF EARTH RESOURCES: (1970-1973 SUPPLEMENT) A LITERATURE SURVEY WITH INDEXES, SECTION 2, INDEXES.

National Aeronautics and Space Administration, Washington, D.C.
Available from the National Technical Information Service, Springfield, VA 22161 as N-75-25236.
Price codes: A18 in paper copy, A01 in microfiche.
NASA SP-7036(01), February 1975. 402 p.

Descriptors: *Bibliographies, *Remote sensing, *Information retrieval, *Documentation, *Indexing, *Great Lakes, Agriculture, Forestry, Geology, Mapping, Instrumentation, Aircraft, Geophysics, Water management(Applied), Data processing, Information exchange, Aerial photography, Satellites(Artificial), Natural resources, Hydrology, Minerals, Environment, Oceanography, Ice, Glaciers, River basins, Estuaries, Estuarine environment, Cities.
Identifiers: Earth resources program, Spacecraft, Mineral resources.

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W77-09345

EARTH RESOURCES—A CONTINUING BIBLIOGRAPHY WITH INDEXES.

National Aeronautics and Space Administration, Washington, D.C.

Available from the National Technical Information Service, Springfield, VA 22161 as N76-17445.
Price codes: A07 in paper copy, A01 in microfiche.
NASA SP-7041(05), October 1975. 150 p.

Descriptors: *Bibliographies, *Great Lakes, *Documentation, *Information retrieval, *Indexing, *Remote sensing, *Abstracts, Agriculture, Forestry, Geology, Mapping, Instrumentation, Aircraft, Geophysics, Water management(Applied), Data processing, Information exchange, Aerial photography, Satellites(Artificial), Natural resources, Hydrology, Minerals, Environment, Oceanography, Ice, Glaciers, River basins, Estuaries, Estuarine environment, Cities.
Identifiers: Earth resources program, Spacecraft, Mineral resources.

This bibliography listed 601 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1975 and March 1975. Emphasis was placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter was grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis. (Froehlich-ISWS)
W77-09346

LIVESTOCK AND THE ENVIRONMENT, A BIBLIOGRAPHY WITH ABSTRACTS—VOLUME III.

East Central Oklahoma State Univ., Ada. School of Environmental Science.
For primary bibliographic entry see Field 05D.
W77-09398

MULTIPHASE FLUID FLOW THROUGH POROUS MEDIA.

Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02G.
W77-09408

Field 10—SCIENTIFIC AND TECHNICAL INFORMATION

Group 10C—Secondary Publication And Distribution

10D. Specialized Information Center Services

USERS MANUAL - OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM.

Environmental Protection Agency, Washington,
D.C. Div. of Oil and Hazardous Materials.
For primary bibliographic entry see Field 05G.
W77-09229

WAMIS ABSTRACTS, NO 2,

Arizona Univ., Tucson. School of Renewable
Natural Resources.
For primary bibliographic entry see Field 10C.
W77-09256

10F. Preparation Of Reviews

MULTIPHASE FLUID FLOW THROUGH POROUS MEDIA.

Colorado State Univ., Fort Collins. Dept. of Civil
Engineering.
For primary bibliographic entry see Field 02G.
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Effluent Standards: Trials and Tribulations, W77-09554 5G
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W77-09463	6E	W77-09542	6E		
W77-09464	6E	W77-09543	6D		
W77-09465	5B	W77-09544	5G		
W77-09466	6A	W77-09545	2I		
W77-09467	6B	W77-09546	5G		
W77-09468	2L	W77-09547	6E		
W77-09469	5C	W77-09548	6E		
W77-09470	5C	W77-09549	6E		
W77-09471	5D	W77-09550	6B		
W77-09472	5B	W77-09551	6E		
W77-09473	5C	W77-09552	6F		
W77-09474	5A	W77-09553	5G		
W77-09475	5B	W77-09554	5G		
W77-09476	5C	W77-09555	6E		
W77-09477	5A	W77-09556	5G		
W77-09478	5G	W77-09557	5G		
W77-09479	5G	W77-09558	5G		
W77-09480	5E	W77-09559	5G		
W77-09481	5G	W77-09560	6E		
W77-09482	5C	W77-09561	6E		
W77-09483	5C	W77-09562	5G		
W77-09484	5C	W77-09563	6E		
W77-09485	5C	W77-09564	6E		
W77-09486	5C	W77-09565	6E		
W77-09487	5C	W77-09566	6E		
W77-09488	2G	W77-09567	6E		
W77-09489	5C	W77-09568	6E		
W77-09490	5A	W77-09569	6E		
W77-09491	5C	W77-09570	6E		

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SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
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Cornell University, Policy Models for Water Resources Systems	W77-09154--09213 09319	61
East Central Oklahoma State University, Agricultural Livestock Wastes	W77-09389--09399 09401--09402 09404	14
Franklin Institute (FIRL), Municipal and Industrial Waste- water Treatment Technology	W77-09317 09409--09425 09595--09600	24
Illinois State Water Survey, Hydrology	W77-09103--09135 09318 09330--09362	67
University of Arizona, Arid Land Water Resources	W77-09296--09309 09312--09316	19
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University of North Carolina, Metropolitan Water Resources Planning and Management	W77-09363--09388	26
University of Wisconsin, Eutrophication	W77-09468--09487 09489--09495 09499--09501 09503--09506 09509--09514 09516--09526	51
University of Wisconsin, Water Resources Economics	W77-09449--09467	19

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B. STATE WATER RESOURCES RESEARCH INSTITUTES	W77-09137--09142 09144--09145 09147--09152 09256--09258 09268--09275 09594	26
C. OTHER		
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Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W77-09589--09591 09593	4
Environment Canada (WATDOC)	W77-09214--09223	10
National Oceanic and Atmospheric Administration	W77-09322--09329	8
Ocean Engineering Information Service (Outer Continental Shelf)	W77-09226 09228--09232 09234--09255	28
Office of Water Research and Technology	W77-09101, 09153 09259--09267 09405--09408	15

